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Lim et al.

(10) **Patent No.: US 8,845,437 B2**
(45) **Date of Patent: Sep. 30, 2014**

(54) **GAMING CHALLENGES WHICH USE LEADERBOARDS THAT RANK CHALLENGE PARTICIPANTS**

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(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/531,264**

(22) Filed: **Jun. 22, 2012**

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Related U.S. Application Data

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(51) **Int. Cl.**
A63F 9/24 (2006.01)
A63F 13/00 (2014.01)

(52) **U.S. Cl.**
USPC **463/42**; 463/31

(58) **Field of Classification Search**
USPC 463/1, 16, 20, 25, 29–31, 40–42
See application file for complete search history.

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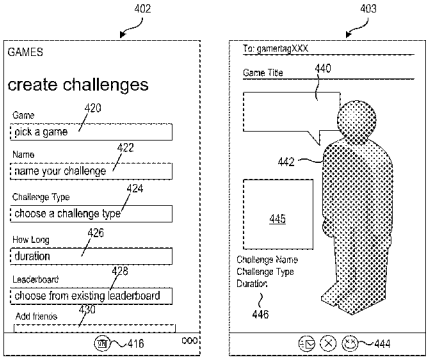
Primary Examiner — Milap Shah
(74) *Attorney, Agent, or Firm* — Andrew Sanders; Micky Minhas

(57) **ABSTRACT**

Disclosed herein are technologies that allow users to create, issue, accept and participate in gaming challenges. A gaming challenge involves participants playing a gaming application to improve their rank on a leaderboard associated with the application until challenge conditions are met or the challenge expires. Challenges can be time-based, objective-based, a tournament or of other type. A challenger can create a challenge by specifying a gaming application to be played, the leaderboard to be used in the challenge, challenge type, challenge duration, and additional challenge criteria. A gaming service can maintain the leaderboard and pass challenge-related notifications between participants. Participants' computing devices can send notices indicating when a challenge has been met or when a participant's relative ranking has changed. A challenger or challengee can select an avatar expression for animating an avatar when a challenge request or acceptance or decline of a challenge is presented at a computing device.

17 Claims, 19 Drawing Sheets



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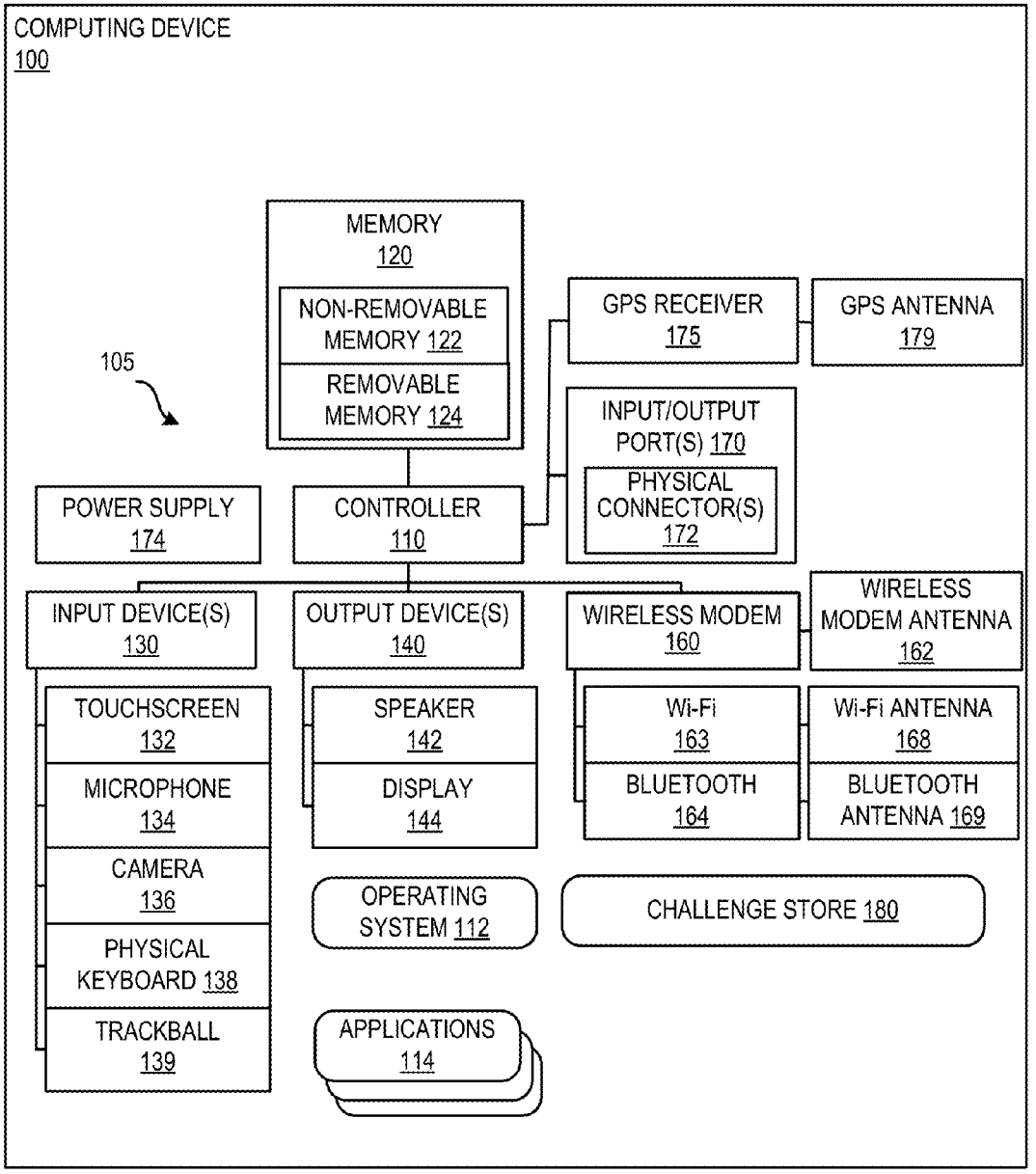
COMPUTING DEVICE
100
105
MEMORY
120
NON-REMOVABLE
MEMORY 122
REMOVABLE
MEMORY 124
GPS RECEIVER
175
GPS ANTENNA
179
INPUT/OUTPUT
PORT(S) 170
PHYSICAL
CONNECTOR(S)
172
POWER SUPPLY
174
CONTROLLER
110
INPUT DEVICE(S)
130
OUTPUT DEVICE(S)
140
WIRELESS MODEM
160
WIRELESS
MODEM ANTENNA
162
TOUCHSCREEN
132
MICROPHONE
134
CAMERA
136
PHYSICAL
KEYBOARD 138
TRACKBALL
139
SPEAKER
142
DISPLAY
144
Wi-Fi
163
BLUETOOTH
164
Wi-Fi ANTENNA
168
BLUETOOTH
ANTENNA 169
OPERATING
SYSTEM 112
CHALLENGE STORE 180
APPLICATIONS
114

FIG. 1

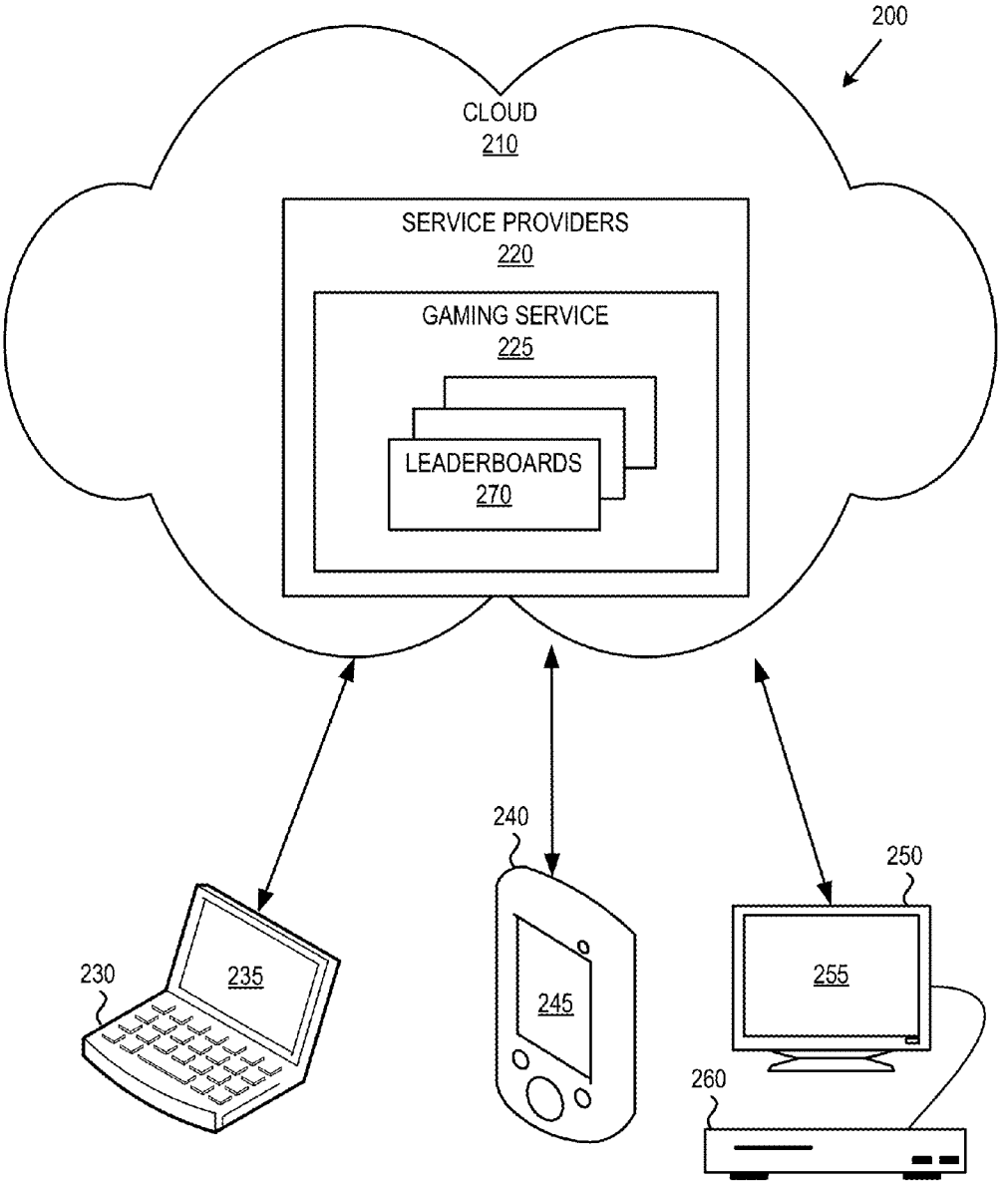
200
CLOUD
210
SERVICE PROVIDERS
220
GAMING SERVICE
225
LEADERBOARDS
270
240
250
230
235
245
255
260

FIG. 2

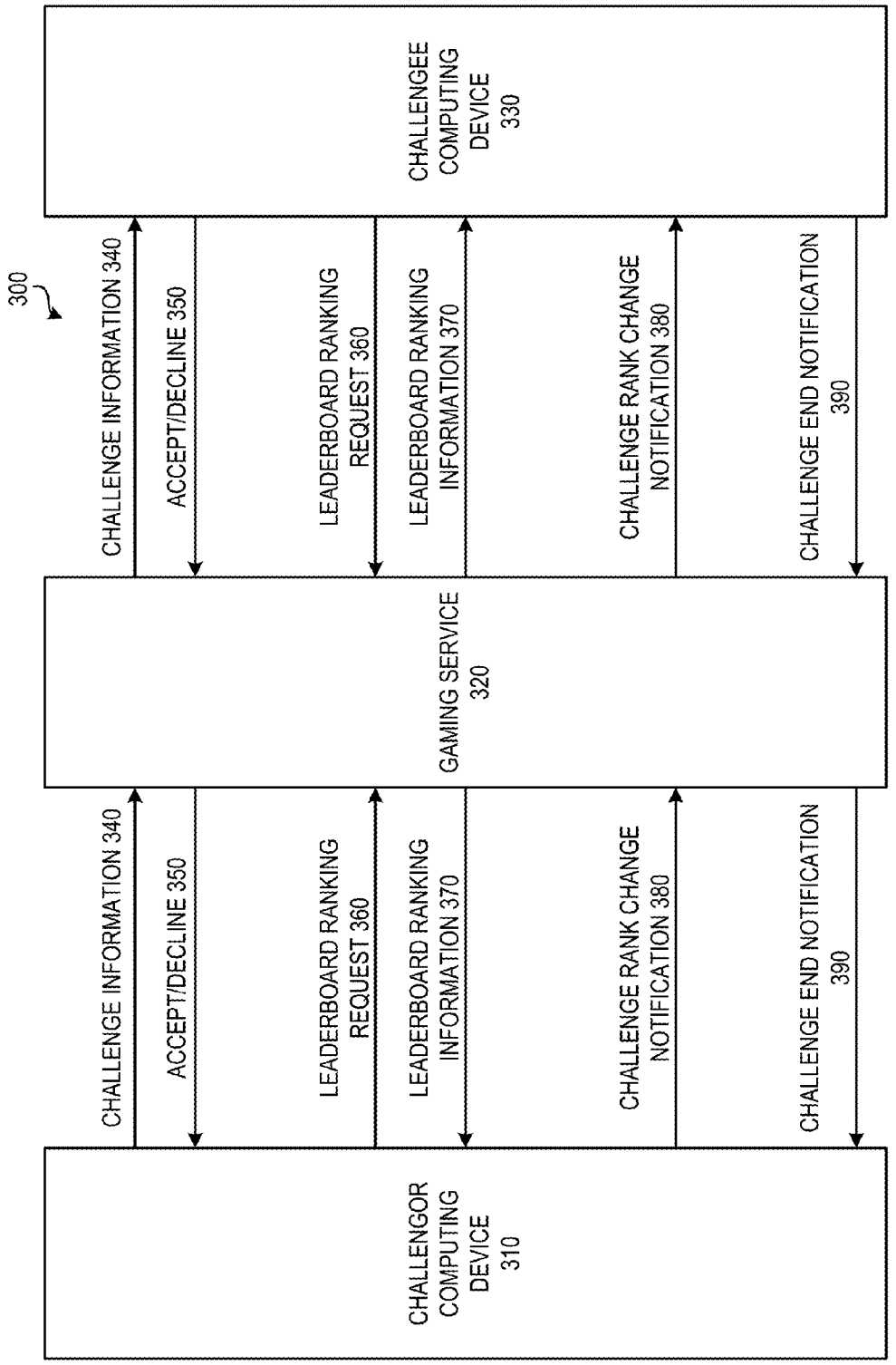
300
CHALLENGOR COMPUTING DEVICE 310
GAMING SERVICE 320
CHALLENGEE COMPUTING DEVICE 330
CHALLENGE INFORMATION 340
ACCEPT/DECLINE 350
LEADERBOARD RANKING REQUEST 360
LEADERBOARD RANKING INFORMATION 370
CHALLENGE RANK CHANGE NOTIFICATION 380
CHALLENGE END NOTIFICATION 390
CHALLENGE INFORMATION 340
ACCEPT/DECLINE 350
LEADERBOARD RANKING REQUEST 360
LEADERBOARD RANKING INFORMATION 370
CHALLENGE RANK CHANGE NOTIFICATION 380
CHALLENGE END NOTIFICATION 390

FIG. 3

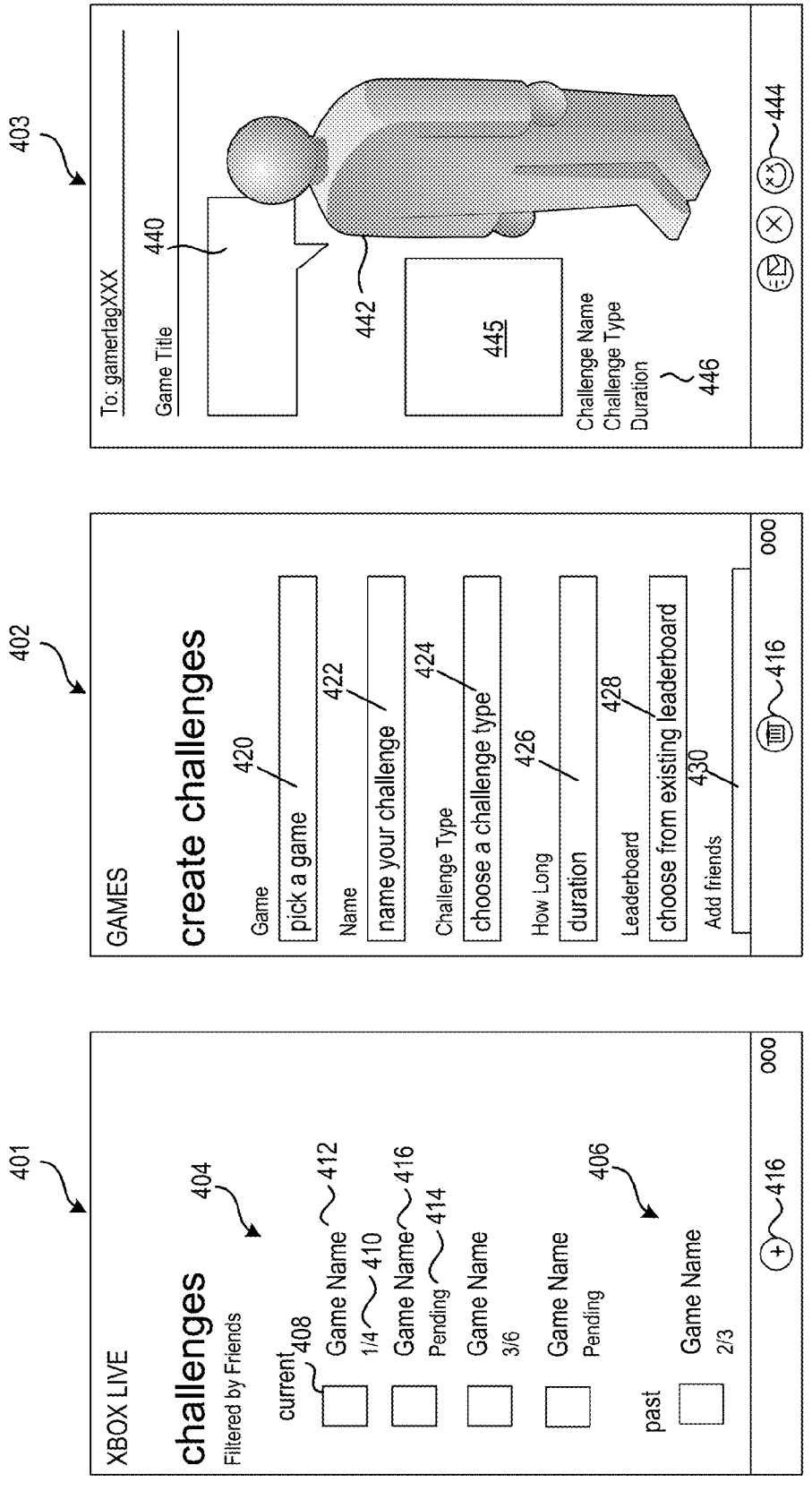

FIG. 4A

FIG. 4B

FIG. 4C

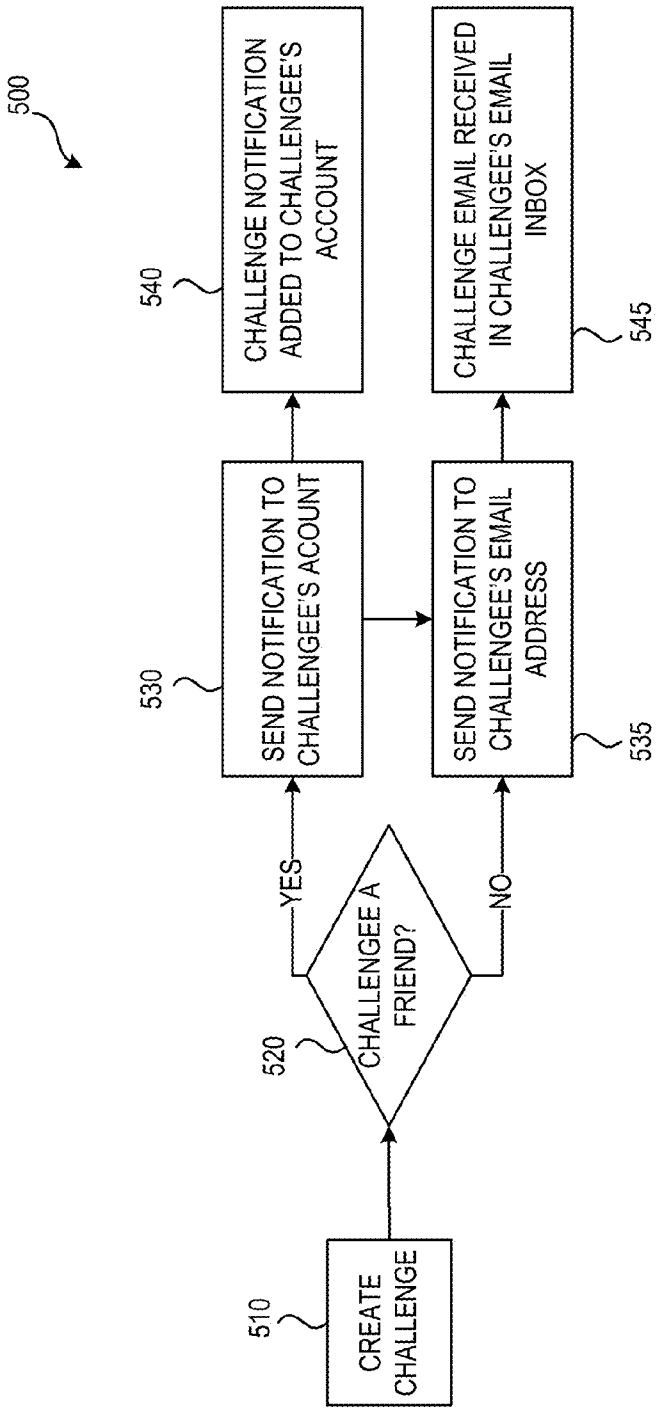
500
CREATE CHALLENGE
510
CHALLENGEE A FRIEND?
520
YES
NO
SEND NOTIFICATION TO CHALLENGEE'S ACOUNT
530
SEND NOTIFICATION TO CHALLENGEE'S EMAIL ADDRESS
535
CHALLENGE NOTIFICATION ADDED TO CHALLENGEE'S ACCOUNT
540
CHALLENGE EMAIL RECEIVED IN CHALLENGEE'S EMAIL INBOX
545

FIG. 5

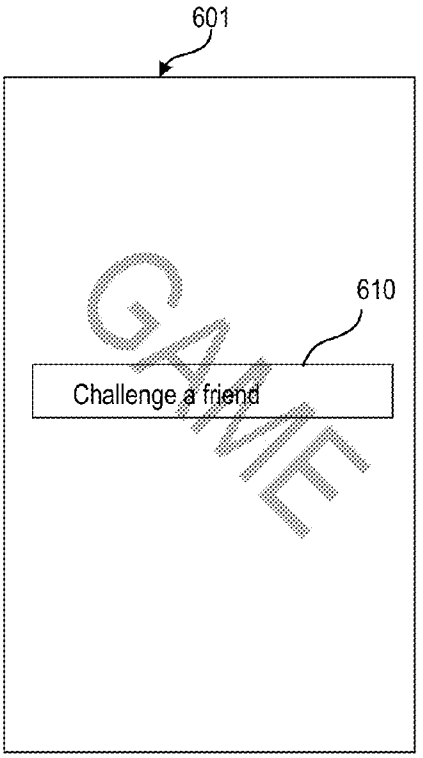

FIG. 6A

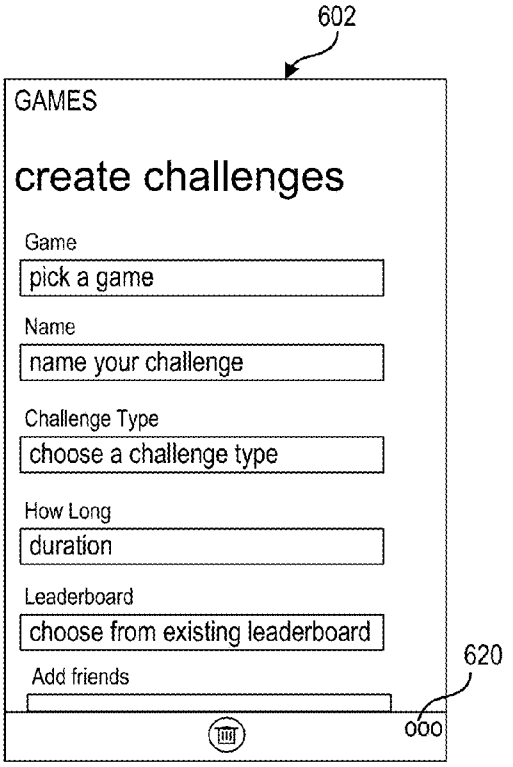

FIG. 6B

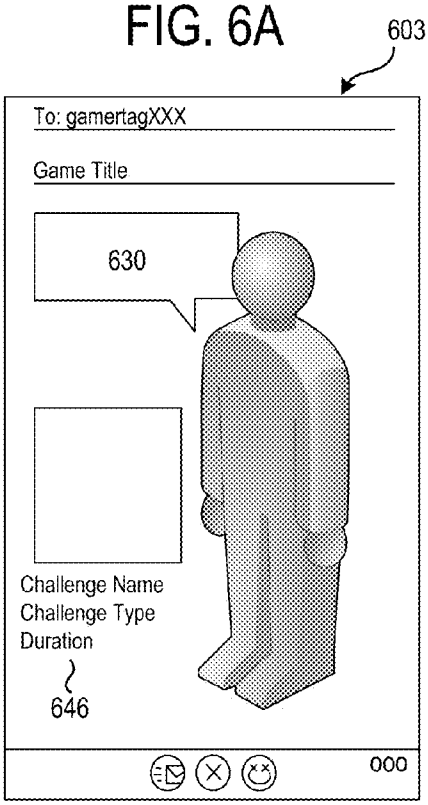

FIG. 6C

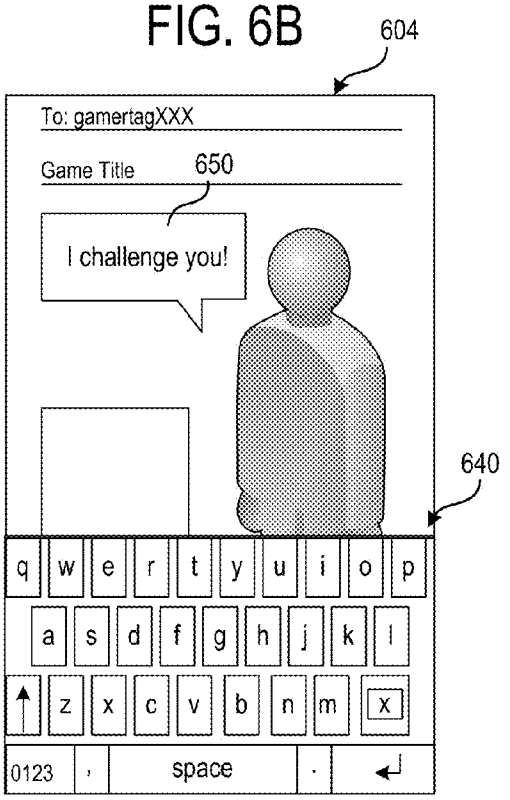

FIG. 6D

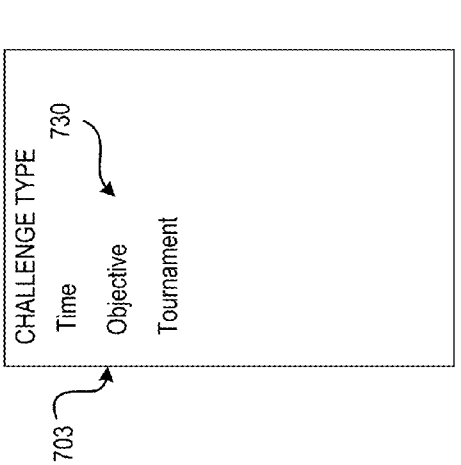

FIG. 7A

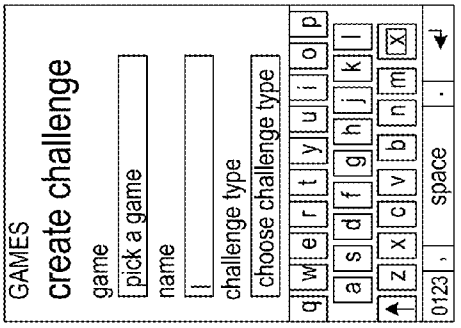

FIG. 7B

FIG. 7C

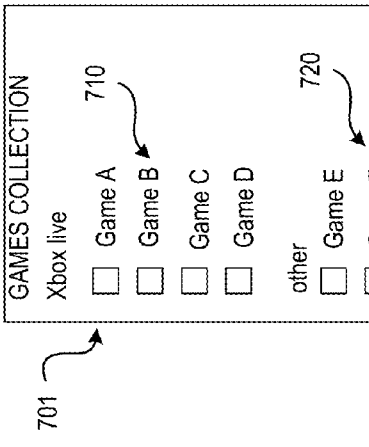

FIG. 7D

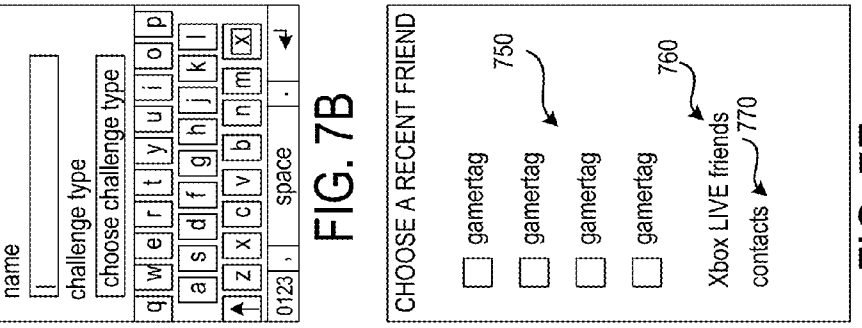

FIG. 7E

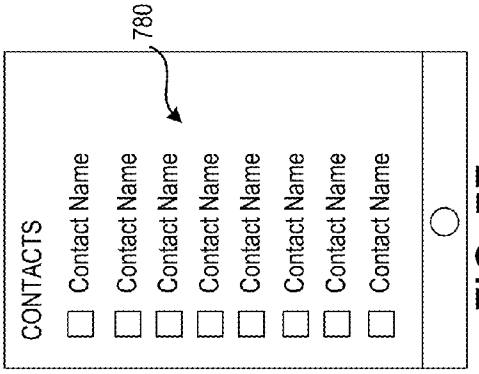

FIG. 7F

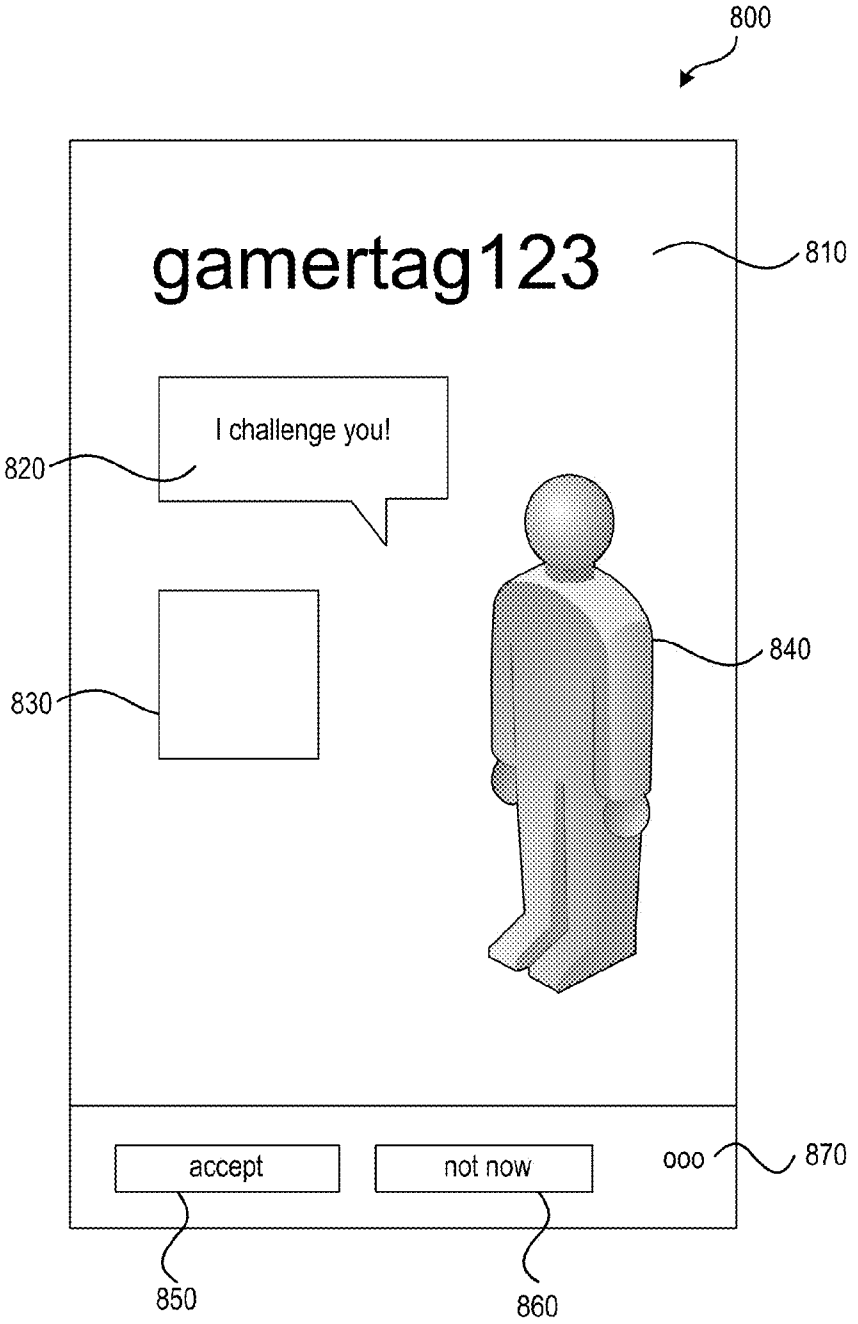
800
gamertag123
810
I challenge you!
820
830
840
accept
not now
ooo
870
850
860

FIG. 8

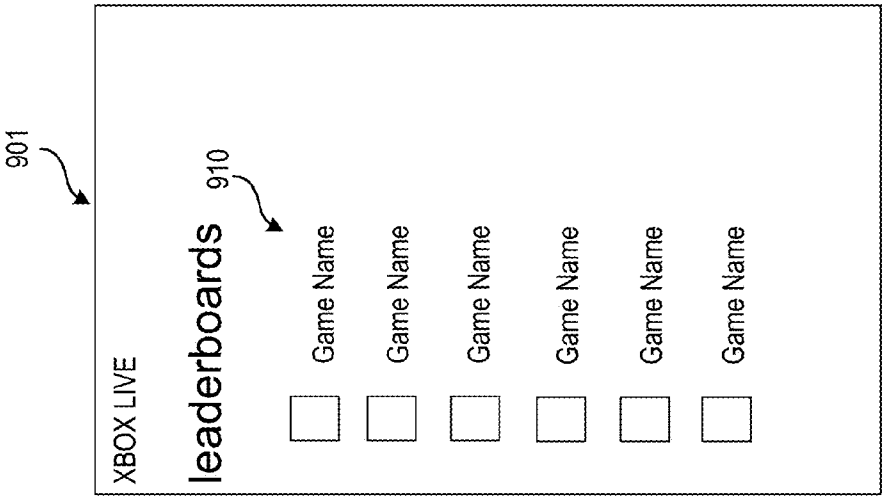

FIG. 9A

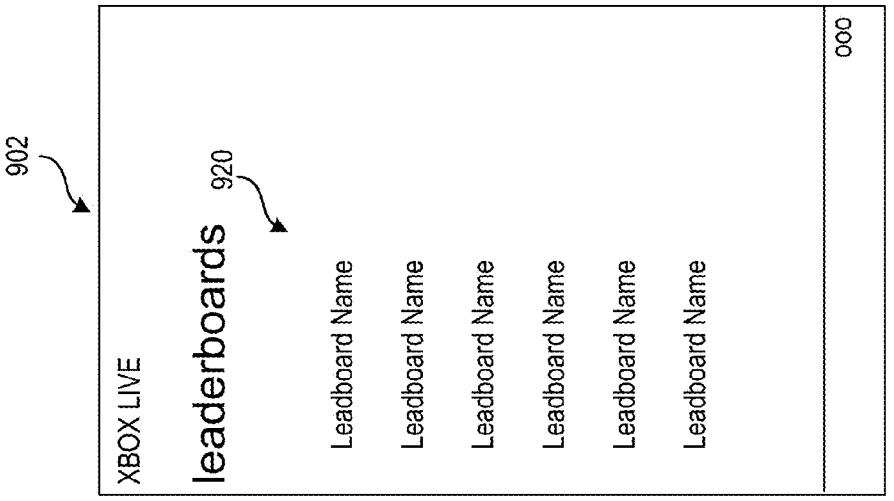

FIG. 9B

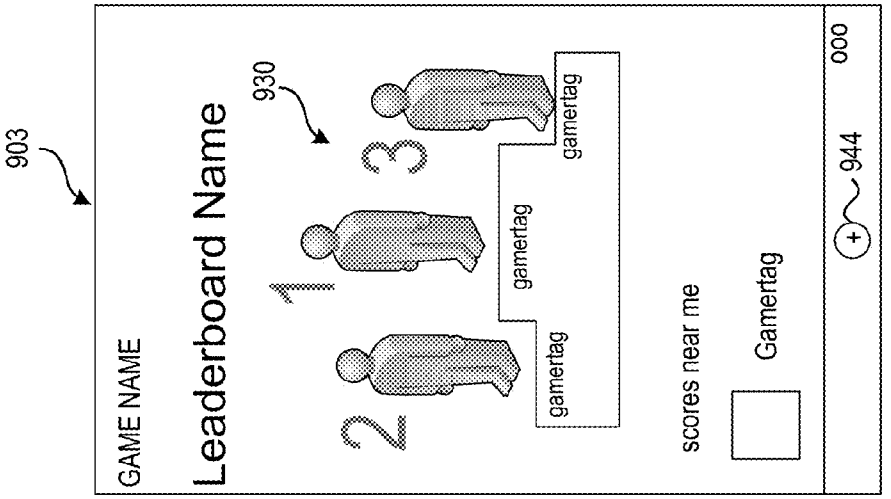

FIG. 9C

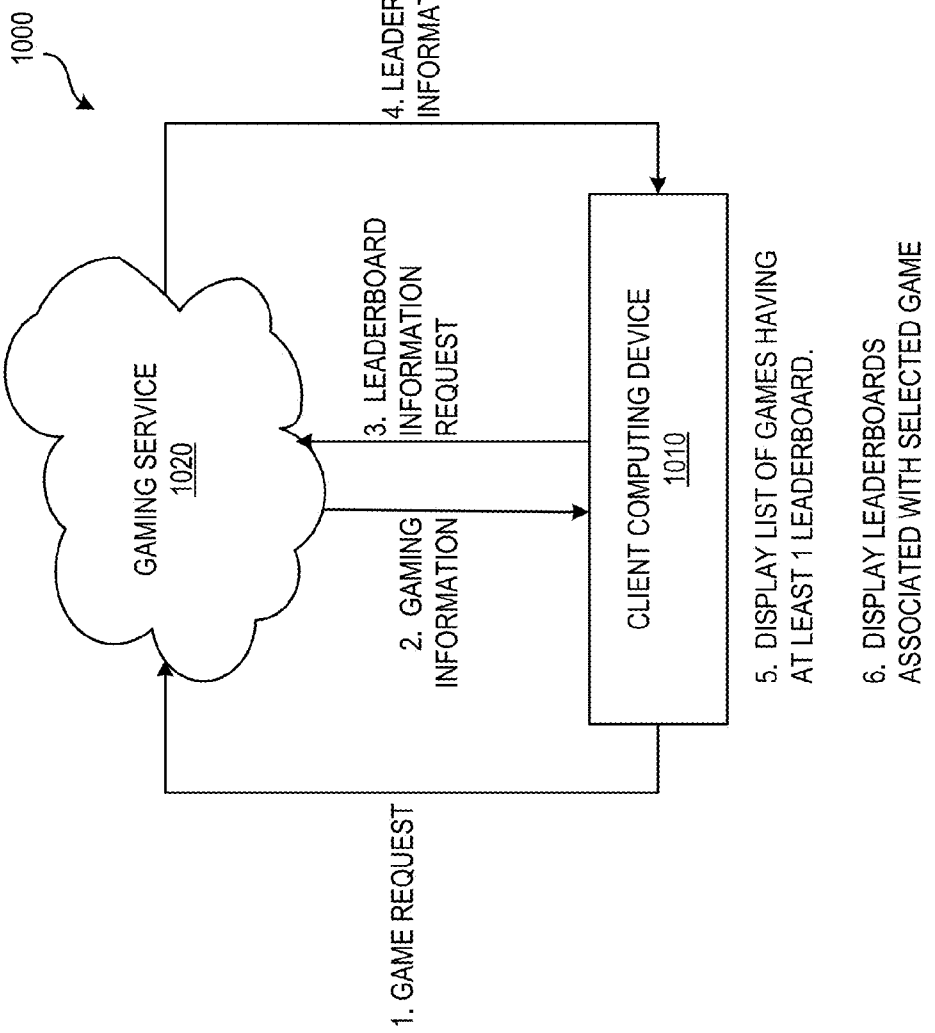
1000
GAMING SERVICE
1020
CLIENT COMPUTING DEVICE
1010
1. GAME REQUEST
2. GAMING INFORMATION
3. LEADERBOARD INFORMATION REQUEST
4. LEADERBOARD INFORMATION
5. DISPLAY LIST OF GAMES HAVING AT LEAST 1 LEADERBOARD.
6. DISPLAY LEADERBOARDS ASSOCIATED WITH SELECTED GAME

FIG. 10

```
{
  "leaderboards":[
    {
    "lbid":3,
    "name":"English Leaderboard_03",
    "rating":"English DecimalColumn"
    },
    {
    "lbid":4,
    "name":"English Leaderboard_04",
    "rating":"English TimeColumn"
    },
    {
    "lbid":6,
    "name":"English Leaderboard_06",
    "rating":"English TimeColumn"}
  ],
  "primaryid":3,
  "titleid":4294840325
}
```


1110

1120

1130

FIG. 11

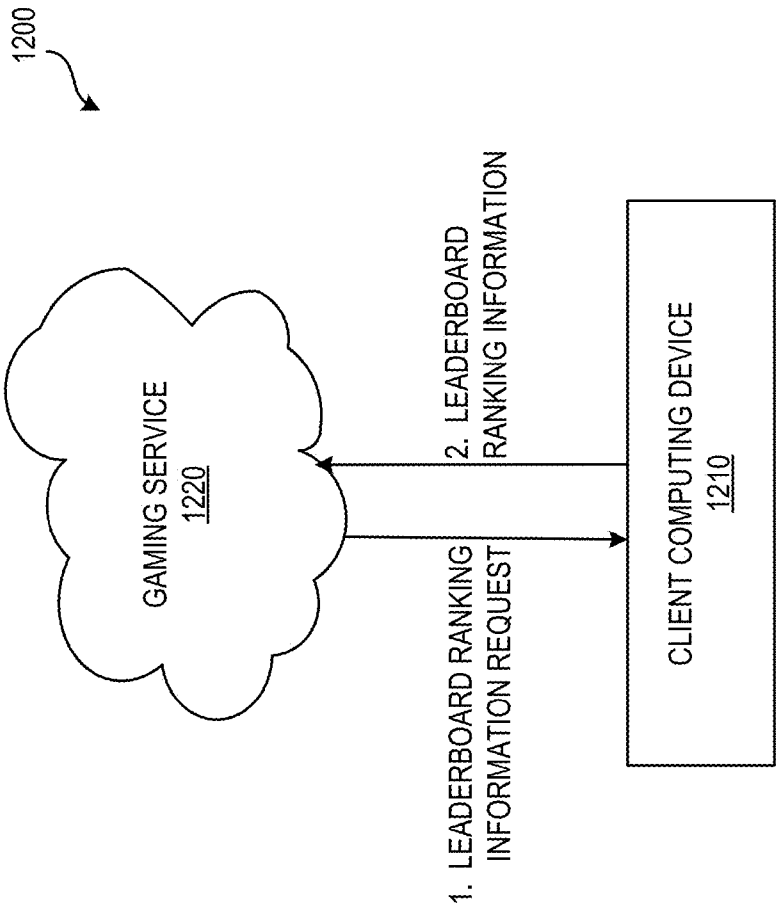
1200
GAMING SERVICE
1220
CLIENT COMPUTING DEVICE
1210
1. LEADERBOARD RANKING INFORMATION REQUEST
2. LEADERBOARD RANKING INFORMATION

FIG. 12

```
{
  "lbname":"Time",
  "pagingInfo":
     {"continuationToken":"2","totalItems":5},
  "rating":"duration",
  "user": null,
  "userList":
   [
     { "gamertag":"CriticalSTRo77",
       "rank":1,
       "rating":"1:23:54.04“,
       “xuid”:1234567890123455},
      { "gamertag":"TrueBlue402",
       "rank":2,
       "rating":"2:19:21.17“,
       “xuid”:1234567890123456 }
  ],
}
```


FIG. 13

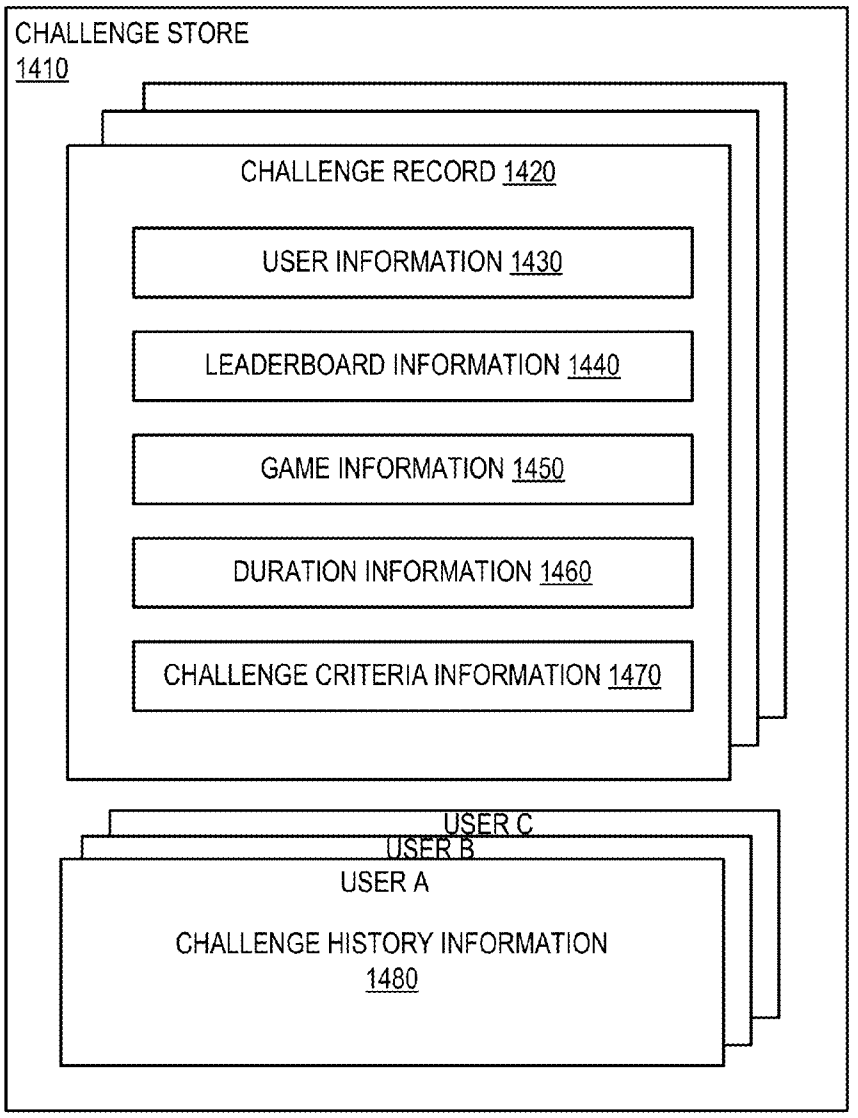
CHALLENGE STORE
1410
CHALLENGE RECORD 1420
USER INFORMATION 1430
LEADERBOARD INFORMATION 1440
GAME INFORMATION 1450
DURATION INFORMATION 1460
CHALLENGE CRITERIA INFORMATION 1470
USER C
USER B
USER A
CHALLENGE HISTORY INFORMATION
1480

FIG. 14

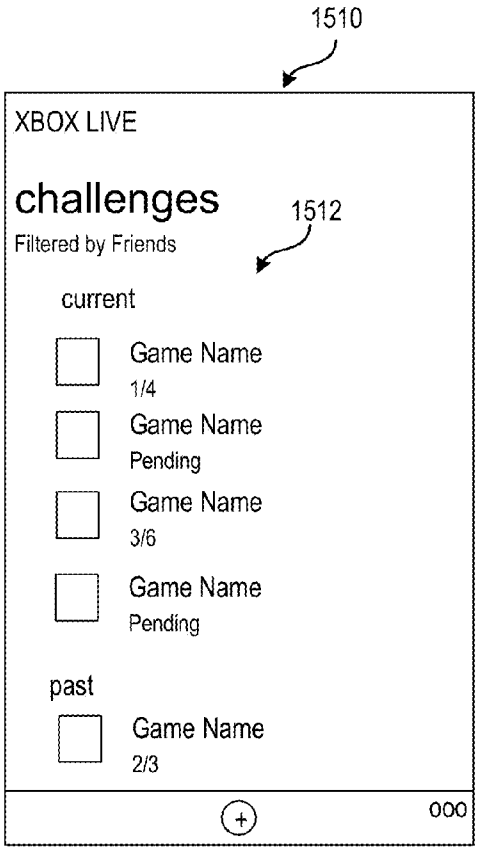

FIG. 15A

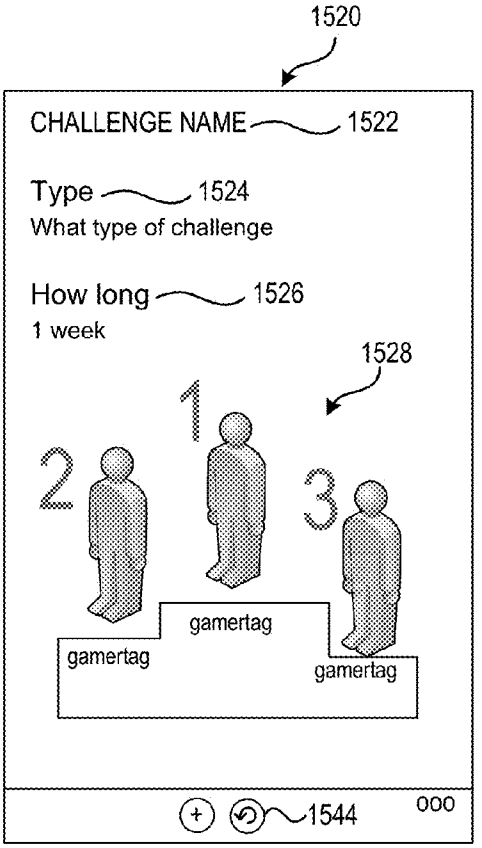

FIG. 15B

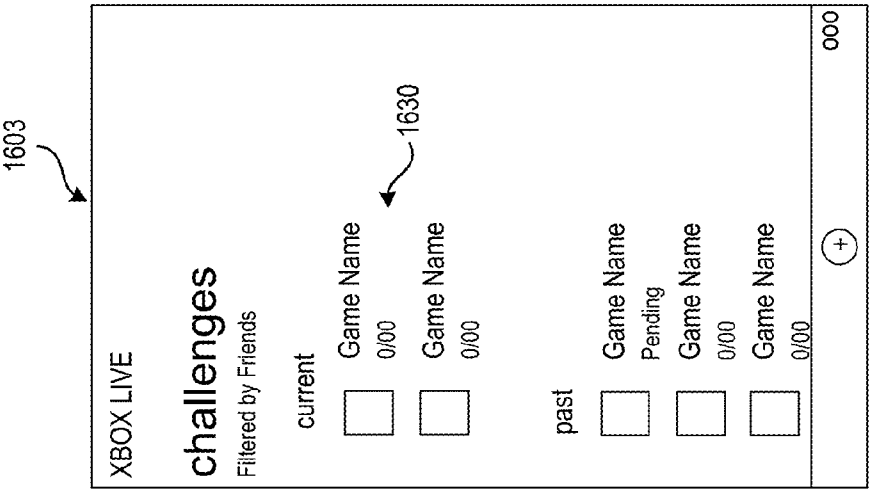

FIG. 16C

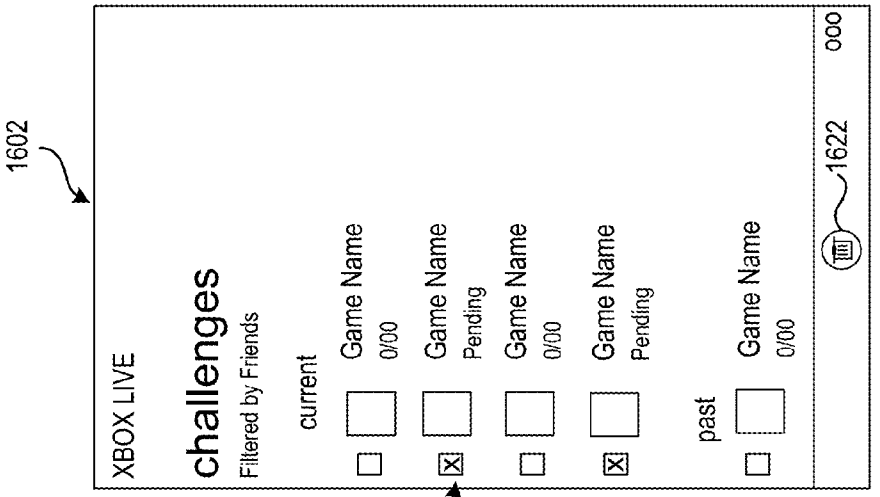

FIG. 16B

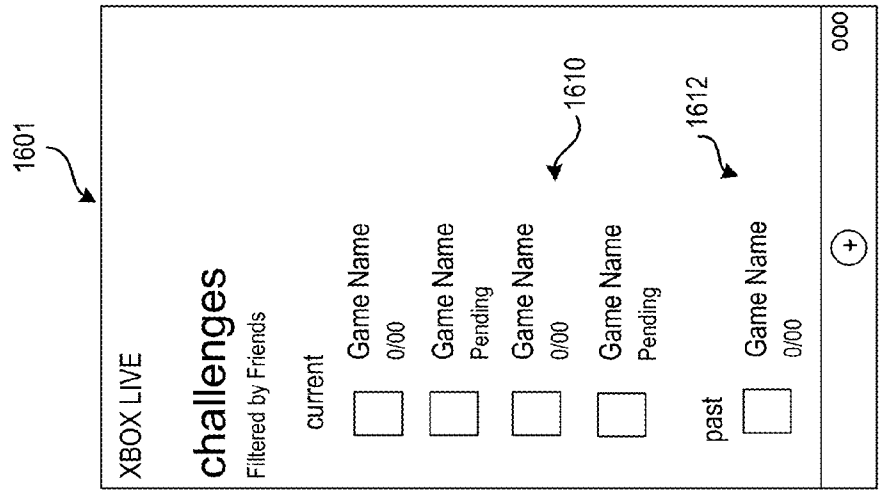

FIG. 16A

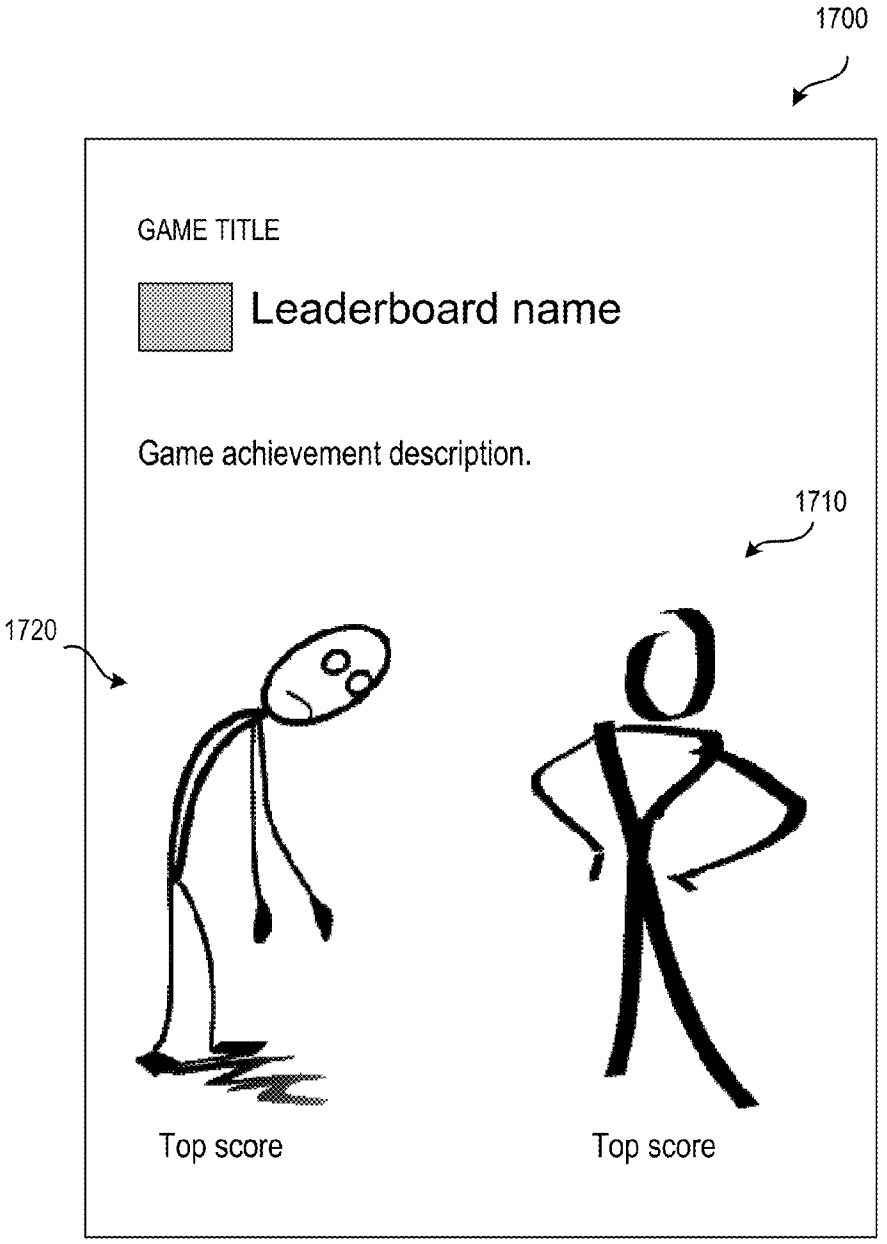
1700
GAME TITLE
Leaderboard name
Game achievement description.
1710
1720
Top score
Top score

FIG. 17

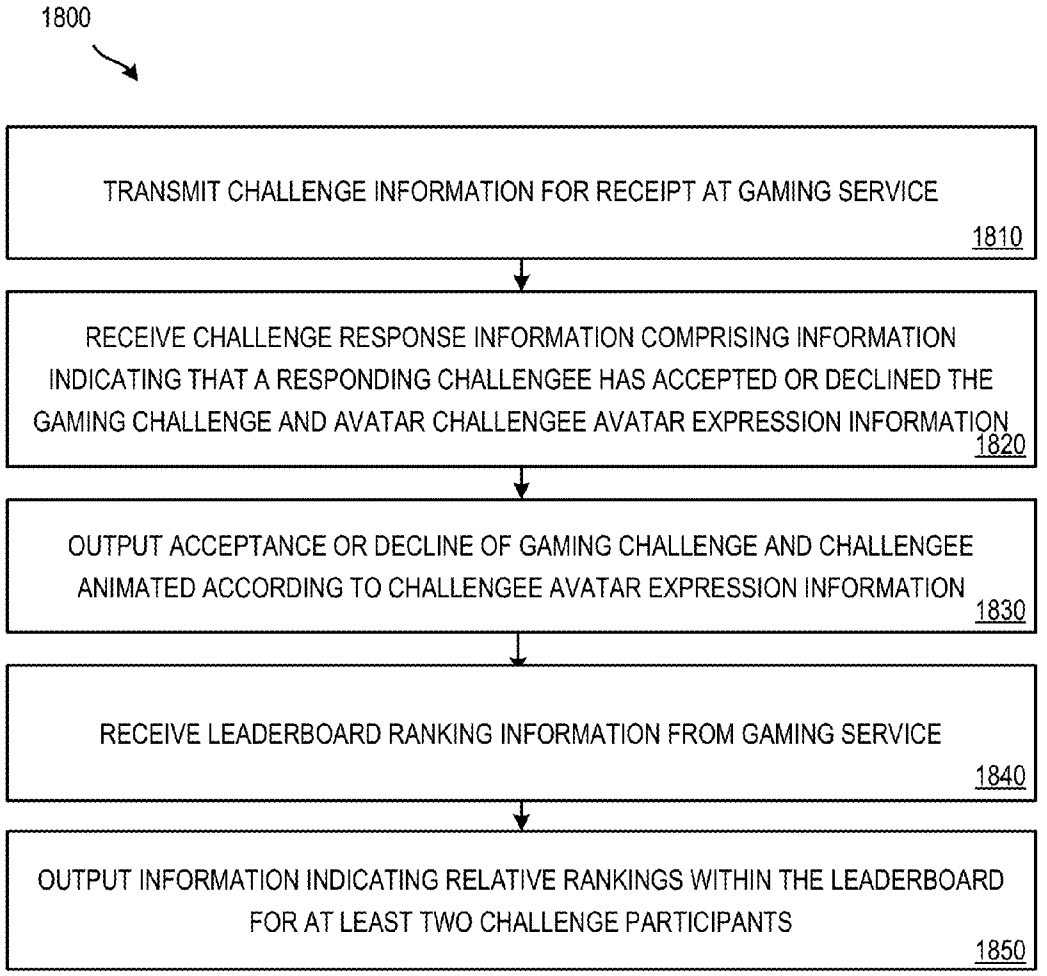
1800
TRANSMIT CHALLENGE INFORMATION FOR RECEIPT AT GAMING SERVICE
1810
RECEIVE CHALLENGE RESPONSE INFORMATION COMPRISING INFORMATION INDICATING THAT A RESPONDING CHALLENGEE HAS ACCEPTED OR DECLINED THE GAMING CHALLENGE AND AVATAR CHALLENGEE AVATAR EXPRESSION INFORMATION
1820
OUTPUT ACCEPTANCE OR DECLINE OF GAMING CHALLENGE AND CHALLENGEE ANIMATED ACCORDING TO CHALLENGEE AVATAR EXPRESSION INFORMATION
1830
RECEIVE LEADERBOARD RANKING INFORMATION FROM GAMING SERVICE
1840
OUTPUT INFORMATION INDICATING RELATIVE RANKINGS WITHIN THE LEADERBOARD FOR AT LEAST TWO CHALLENGE PARTICIPANTS
1850

FIG. 18

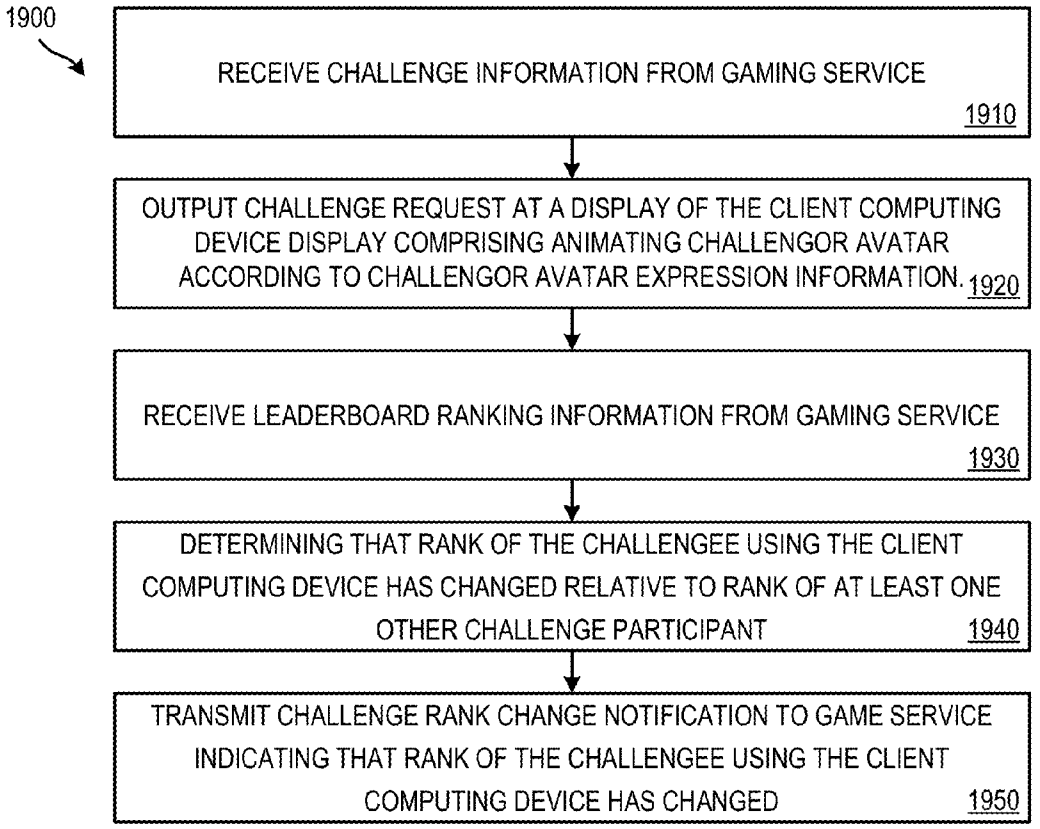
1900
RECEIVE CHALLENGE INFORMATION FROM GAMING SERVICE
1910
OUTPUT CHALLENGE REQUEST AT A DISPLAY OF THE CLIENT COMPUTING DEVICE DISPLAY COMPRISING ANIMATING CHALLENGOR AVATAR ACCORDING TO CHALLENGOR AVATAR EXPRESSION INFORMATION.
1920
RECEIVE LEADERBOARD RANKING INFORMATION FROM GAMING SERVICE
1930
DETERMINING THAT RANK OF THE CHALLENGEE USING THE CLIENT COMPUTING DEVICE HAS CHANGED RELATIVE TO RANK OF AT LEAST ONE OTHER CHALLENGE PARTICIPANT
1940
TRANSMIT CHALLENGE RANK CHANGE NOTIFICATION TO GAME SERVICE INDICATING THAT RANK OF THE CHALLENGEE USING THE CLIENT COMPUTING DEVICE HAS CHANGED
1950

FIG. 19

GAMING CHALLENGES WHICH USE LEADERBOARDS THAT RANK CHALLENGE PARTICIPANTS

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority to, and the benefit of, U.S. Provisional Application No. 61/640,593 filed Apr. 30, 2012, which is incorporated herein by reference.

BACKGROUND

Gaming applications run on a wide variety of computing platforms, such as dedicated gaming consoles, desktop and laptop computers, social media networks and mobile devices. Users can compete against other users in various fashions, depending on the platform. For example, multiple users can simultaneously compete against others in a multi-player game if the platform has multiple gaming controllers. Alternatively, users can compete by taking turns in playing a single-player game. Internet-enabled gaming platforms allow users to measure their gaming prowess against a broader community of users by posting their scores, times, rankings or other gaming metrics to leaderboards maintained in the cloud.

SUMMARY

This Summary is provided to introduce a selection of concepts, in a simplified form, that are further described hereafter in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter nor is it intended to be used to limit the scope of the claimed subject matter.

Gaming challenge technologies are disclosed that allow users to compete against one another without requiring modifications to a gaming application, such as a single-player gaming application, that is played as part of a challenge.

In one embodiment, a challenger creates a challenge at his or her computing device, such as a smartphone, by specifying the users to invite to the challenge, the game to be played in the challenge and the leaderboard to be used in determining a challenge winner. The challenger can also specify the challenge type, the duration of the challenge, any award that is to be awarded to the challenge winner, and other criteria. In some embodiments, the challenge can be a tournament comprising individual challenges involving pairs of challenge participants.

In some embodiments, the challenger can specify an avatar expression (boastful, confident, happy, etc.), indicating how his or her avatar is to be animated when a challenge request is displayed at a challengee's computing device. Thus, avatar facial and body expressions can be selectively modified by the user to indicate a mood, feeling or emotion of the avatar. Challengees can similarly indicate expressions for their own avatars when a challenge acceptance or decline notice is presented at the challenger's computing device.

In some embodiments, the leaderboard is a cloud-based leaderboard maintained by a gaming service. The challenge participants' computing devices can receive leaderboard ranking information from the gaming service while the challenge is ongoing, display the current rankings of the challenge participants, notify other participants when there is a change in the relative rank of challenge participants, and when a challenge has ended.

The foregoing and other objects, features and advantages of the disclosed technologies will become more apparent from the following detailed description, which proceeds with reference to the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a system diagram depicting an exemplary computing device.

FIG. **2** illustrates a generalized example of a suitable implementation environment in which described embodiments, techniques, and technologies may be implemented.

FIG. **3** shows an exemplary flow of information between a computing device operated by a challenger, a gaming service, and a computing device operated by a challengee.

FIGS. **4**A-**4**C shows exemplary user interfaces that can be displayed at a computing device as part of creating a gaming challenge.

FIG. **5** is an exemplary flowchart for sending and receiving a gaming challenge.

FIGS. **6**A-**6**D show exemplary user interfaces that can be displayed at a computing device as part of creating a gaming challenge within the context of gaming application.

FIGS. **7**A-**7**F show exemplary user interfaces that can be displayed at a computing device as part of creating a gaming challenge.

FIG. **8** shows an exemplary interstitial page that can be presented at a computing device as part of a challenge notification.

FIGS. **9**A-**9**C show exemplary user interfaces that can be displayed at a computing device for navigating to a particular leaderboard and showing the rankings of challenge participants.

FIG. **10** shows a first exemplary flow of information between a client computing device and a gaming service.

FIG. **11** shows exemplary leaderboard information that can be transmitted from a gaming service to a client computing device.

FIG. **12** shows a second exemplary flow of information between a client computing device and a gaming service.

FIG. **13** shows exemplary leaderboard ranking information that can be transmitted from a gaming service to a client computing device.

FIG. **14** shows an exemplary challenge store that can be stored at a computing device.

FIG. **15** shows exemplary user interfaces that display a leaderboard of a current challenge.

FIG. **16** shows exemplary user interfaces for managing challenges.

FIG. **17** shows an exemplary user interface displaying a winning user's avatar animated with a positive expression and a losing user's avatar animated with a negative expression.

FIG. **18** is a flowchart of an exemplary method of issuing a gaming challenge.

FIG. **19** is a flowchart of an exemplary method of accepting a gaming challenge.

DETAILED DESCRIPTION

FIG. **1** is a system diagram depicting an exemplary computing device **100** that can be used to perform methods described herein. The computing device **100** can include a variety of optional hardware and software components **105**. Generally, components **105** can communicate with other components, although not all connections are shown, for ease of illustration. The computing device **100** can be any of a variety of computing devices including mobile (e.g., cell

phone, smartphone, handheld computer, laptop computer, notebook computer, tablet device, slate device, media player, handheld gaming console, Personal Digital Assistant (PDA)) and non-mobile (e.g., desktop computers, servers, gaming consoles, smart televisions) computing devices and can allow wired or wireless communication with one or more networks such as a Wi-Fi, LAN, WAN, cellular or satellite network.

The computing device **100** can include a controller or processor **110** (e.g., signal processor, graphics processing unit (GPU), microprocessor, ASIC, or other control and processing logic circuitry or software) for performing such tasks as signal coding, graphics processing, data processing, input/output processing, power control, and/or other functions.

An operating system **112** can control the allocation and usage of the components **105** and support for one or more application programs **114**. The application programs **114** can include gaming applications, common mobile computing applications (e.g., email applications, calendars, contact managers, web browsers, messaging applications) as well as other computing applications.

The mobile computing device **100** can include memory **120**. Memory **120** can include non-removable memory **122** and removable memory **124**. The non-removable, or embedded memory, **122** can include RAM, ROM, flash memory, a hard drive, or other memory storage technologies. The removable memory **124** can include flash memory cards (e.g., SD (Secure Digital) cards), memory sticks, Subscriber Identity Module (SIM) cards, which are well known in GSM (Global System for Mobile Communication) systems, or other memory storage technologies, such as "smart cards." The memory **120** can be used for storing data and/or computer-executable instructions for running the operating system **112** and the application programs **114** on the device **100**. Example data can include web pages, text, images, sound files, video data, a challenge store **180** that stores information about active and past gaming challenges, or other data sets to be sent to and/or received from one or more network servers or other devices by the mobile computing device **100** via one or more wired or wireless networks. The memory **120** can be used to store a subscriber identifier, such as an International Mobile Subscriber Identity (IMSI), and an equipment identifier, such as an International Mobile Equipment Identifier (IMEI). Such identifiers can be transmitted to a network server to identify users and equipment. The computing device **100** can also have access to external memory (not shown) such as external hard drives.

The computing device **100** can support one or more input devices **130**, such as a touchscreen **132**, microphone **134**, camera **136**, physical keyboard **138** and/or trackball **139** and one or more output devices **140**, such as a speaker **142**, and a display **144**. Other possible output devices (not shown) can include piezoelectric or other haptic output devices. Any of the input devices **130** and output devices **140** can be internal to, external to, or removably attachable with the computing device **100**. External input and output devices **130** and **140** can communicate with the computing device **100** via wired or wireless connections. Some devices can serve more than one input/output function. For example, touchscreen **132** and display **144** can be combined in a single input/output device.

A wireless modem **160** can be coupled to a wireless modem antenna **162** and can support two-way communications between the mobile computing device **100** and external devices. The modem **160** and the antenna **162** are shown generically and can be a wireless cellular modem for communicating with a mobile cellular communication network. The wireless modem **160** can comprise other radio-based modems such as a Wi-Fi modem **163** or a Bluetooth modem **164**, each of which can be coupled to its own antenna (e.g., Wi-Fi antenna **168**, Bluetooth antenna **169**). The wireless modem **160** is typically configured for communication with one or more cellular networks, such as a GSM network for data and voice communications within a single cellular network, between cellular networks, or between the mobile computing device and a public switched telephone network (PSTN).

The mobile computing device **100** can further include at least one input/output port **170** (which can be, for example, a USB port, IEEE 1394 (FireWire) port, and/or RS-232 port) comprising physical connectors **172**, a power supply **174** and a satellite navigation system receiver such as a GPS receiver **175**. The GPS receiver **175** can be coupled to a GPS antenna **179**. The illustrated components **105** are not required or all-inclusive, as any components can be deleted and other components can be added.

FIG. **2** illustrates a generalized example of a suitable implementation environment **200** in which described embodiments, techniques, and technologies may be implemented.

In example environment **200**, various types of services (e.g., computing services) are provided by a cloud **210**. For example, the cloud **210** can comprise a collection of computing devices, which may be located centrally or distributed, that provide cloud-based services to various types of users and devices connected via a network such as the Internet. The implementation environment **200** can be used in different ways to accomplish computing tasks. For example, some tasks (e.g., processing user input and presenting a user interface) can be performed on local computing devices (e.g., connected devices **230**, **240**, **250**) while other tasks (e.g., storage of data to be used in subsequent processing) can be performed in the cloud **210**.

In example environment **200**, the cloud **210** provides services for connected devices **230**, **240**, **250** with a variety of screen capabilities. Connected device **230** represents a device with a computer screen (e.g., a mid-size screen **235**). For example, connected device **230** could be a desktop, laptop, notebook, netbook or tablet computer or the like. Connected device **240** represents a mobile computing device with a mobile computing device screen **245** (e.g., a small-size screen). For example, connected device **240** could be a mobile phone, smartphone, handheld gaming console, personal digital assistant or the like. Connected device **250** represents a device with a large screen **255**. For example, connected device **250** could be a television with Internet connectivity, a television connected to another device capable of connecting to the cloud such as a set-top box or gaming console **260**, a monitor connected to a desktop and server computer, or the like. Alternatively, devices without screen capabilities also can be used in example environment **200**. For example, the cloud **210** can provide services for one or more computers (e.g., server computers) without displays.

Services can be provided by the cloud **210** through service providers **220**, or through other providers of online services (not depicted). For example, cloud services can be customized to the screen size, display capability, and/or touchscreen capability of a particular connected device (e.g., connected devices **230**, **240**, **250**). Services that can be provided by the service providers **220** include, for example, email, Short Message Service (SMS), Multimedia Message Service (MMS), social networking and website hosting. The service providers can host online marketplaces offering wide varieties of goods and services such as software applications and upgrades and

media content which can be obtained by users with or without purchase and for download from the cloud or delivery through postal mail.

In example environment **200**, the cloud **210** provides the technologies and solutions described herein to the various connected devices **230**, **240**, **250** using, at least in part, the service providers **220**. For example, the service providers **220** can provide a centralized solution for various cloud-based services. The service providers **220** can manage service subscriptions for users and devices (e.g., for the connected devices **230**, **240**, **250** and their respective users).

In one embodiment, the cloud-based service providers **220** comprise a gaming service **225**, such as Microsoft's Xbox LIVE® service. The gaming service **225** maintains one or more leaderboards **270** for gaming applications and is capable of passing messages or notifications between users of the gaming service. The gaming service **225** can be implemented by one or more servers. Generally, as used herein, the term "client computing device" refers to a computing device capable of communicating with the gaming service **225**, such as computing devices **230**, **240**, **250** or **260**.

The technologies disclosed herein enable users to invite other users to participate in gaming challenges that involve the playing of a gaming application. Typically, the gaming applications do not need to be modified in order to support the challenge technologies described herein. In one embodiment, gaming challenges are created, issued, received, accepted or declined, and participated in at any of the computing devices described herein. A winner of a challenge can be determined by monitoring the rank of challenge participants on a leaderboard associated with the gaming application involved in the challenge, when a challenge has expired, or when other challenge conditions have been met (e.g., a specified achievement has been unlocked).

FIG. **3** shows an exemplary flow of information **300** between a computing device operated by a challenger (challenger computing device) **310**, a gaming service **320**, and a computing device operated by a challengee (challengee computing device) **330** in a gaming challenge. The computing devices **310** and **330** can be any of the computing devices described herein.

Generally, as used herein, the term "challenger" refers to a user that creates and issues a gaming challenge and the term "challengee" refers to a user to which a challenge has been issued. Generally, as used herein, the term "challenge participants" refers to the challenger and challengees collectively. Generally, as used herein, the term "gaming challenge" refers to a challenge issued by a challenger to one or more challengees that involves playing a gaming application and that uses a leaderboard for determining a challenge winner.

A gaming challenge is created by a challenger at the challenger computing device **310**. A gaming challenge can be created within the context of a gaming application or outside the content of a gaming application, such as within the context of a challenge feature of a client computing device operating system. After a gaming challenge has been created at the challenger computing device **310**, challenge information **340** is transmitted from the device **310** to the gaming service **320**, and relayed to the challengee computing device **330**. There can be more than one challengee computing devices **330** if there is more than one challengee, and there can be more than one challengee computing device **330** for a challengee. For example, a challengee can receive a toast notification on a smartphone, a challenge invite via email on a laptop computer, and a challenge request notification on a web user interface presented on a desktop computer. Although FIG. **3** shows information being passed between the computing devices **310** and **330** via the gaming service **320** as having the same reference numbers (i.e., challenge information **340**, accept/decline information **350**, challenge rank change notification **380** and challenge end notification **390**), the information passed between device **310** and the service **320** can vary from that passed between the service **320** and device **330** due to, for example, processing of the information or notifications added to the information by the gaming service **320**.

Generally, as used herein, the term "notification" refers to a message passed between client computing devices or information contained therein. For example, a challenge request notification can refer to challenge information contained therein, and a change rank change notification can comprise challenge rank change information. The term "notification" can also refer to a notice presented at a display of a computing device. The notification can be passed between computing devices via a gaming service or passed between computing devices without the use of the gaming service. Various notifications are described herein, but, in general, the gaming service is agnostic to notification types. Processing of notifications by the gaming system is generally limited to receiving notifications, determining the recipient(s) of the notifications, and transmitting the notifications to the intended recipients.

The gaming service **320** can be a cloud-based service that stores data (e.g., leaderboards) that is used by client computing devices in determining progress of challenge participants to a challenge and/or if a challenge has been met. In some embodiments, the gaming service **320** is a cloud-based service that keeps track of leaderboards for various games that can be played at the computing devices and passes notifications such as challenge issue notifications, challenge rank change notifications and challenge end notifications, as described herein. In various embodiments, the gaming service **320** can also manage various aspects of a challenge such as creating and maintaining leaderboards specific to a certain challenge and sending leaderboard ranking information for participants of a particular gaming challenge in response to a leaderboard ranking request from a computing device. The gaming service can be a dedicated gaming service (e.g., Microsoft's Xbox LIVE® service), part of another cloud-based service, such as an online gaming environment or community (e.g., massively multiplayer online game), social media platform or the like.

FIGS. **4A-4C** show exemplary user interfaces **401-403** that can be displayed at a computing device as part of creating a gaming challenge. The user interfaces **401-403** can be displayed outside of the context of a gaming application, such as in the context of a user accessing a "challenges" feature of a smartphone operating system (e.g., by tapping a "challenges" tile or icon from a home page).

FIG. **4A** shows an exemplary user interface **401** that can be displayed in response to, for example, a user navigating to a "challenges" feature of a computing device. The user interface **401** comprises a list of gaming challenges. The user interface **401** comprises a list of current or active challenges **404** and past challenges **406**. The current challenges list **404** can comprise challenges that have already been accepted or declined or that have yet to be accepted or declined by a user. User interface **401** displays a game name, thumbnail image **408** and a challenge status indicator for the listed challenges. The challenge status indicator "¼" **410** for challenge **412** indicates that the user is currently ranked first out of four challenge participants. The challenge status indicator "pending" **414** does not provide any relative ranking information and indicates that the challenge **416** is in progress.

FIG. **4B** shows an exemplary user interface **402** that can be displayed in response to a user selecting the create challenge

button **416** in user interface **401**. In user interface **402**, a user can enter the gaming application to be played in the challenge in field **420** (e.g., "Extreme Motocross"), a gaming challenge name in field **422** (e.g., "Bob's Motocross Challenge"), a challenge type in field **424** ("Fastest Lap"), a duration for the gaming challenge in field **426** (e.g., "three days"), a leaderboard associated with the gaming application to be used in determining whether the gaming challenge has been met in field **428** (e.g., "Extreme Motocross—Course 1—Fastest Lap"), and one or more users that are to be invited to the challenge (i.e., the challengees for the challenge) in field **430** (e.g., "johndoe111", "johnsmith7").

The user interface **402** can comprise more or fewer fields than those shown in the display **402**. For example, one or more challenge criterion fields can be included in user interface **402**, such as an award field that allows a challenger to indicate an award that is to be granted to the winner of the challenge. A challenge award could be an avatar awardable. Avatar awardables include items that change an avatar's appearance (e.g., wardrobe items), provide added the avatar with added functionality or abilities (e.g., increased strength, defensive abilities, magical power) and other add-ons. Examples of avatar awardables include weapons, accessories, armor, powers, spells, equipment power-ups (e.g., for racing game—better handling tires, higher maximum speed, greater acceleration), experience points, and abilities.

Additional challenge criterion include, for example, a game difficulty setting, the level, mission, race course or quest that is to be played as part of the challenge; and the like. In some embodiments, these challenge criterion fields can appear based on values provided for various fields in user interface **402**. For example, if the selected gaming application is a racing game, the user interface **402** can be refreshed upon entry of the gaming application title to show a field prompting the user to enter which racecourse is to be played.

In some embodiments, the values of one or more of the fields is the display **402** are limited to those supported by the gaming service and a user can select a value for the field from, for example, a drop-down list. For example, the computing device **310** can request from the gaming service the leaderboards that the service maintains for the gaming application entered by the user. The maintained leaderboards can then be presented in a list to the user, and the user can select from among the leaderboards presented in the list. In some embodiments, the gaming service can provide to the computing device the challenge types, levels (tracks, quests, missions, etc.), difficulty levels and the like for a gaming application. Alternatively, this information can be requested by the computing device from the gaming application executing thereon, or it can be retrieved from a challenge store stored locally at the computing device.

The gaming application provided in field **420** can be any gaming application for which a gaming service maintains a leaderboard. Typically, a gaming challenge utilizes a leaderboard maintained by the gaming service that tracks a game metric for users regardless of whether they are participating in a challenge. In some embodiments, the gaming service can create and maintain a leaderboard for a particular challenge that can be discarded by the gaming service after the challenge has ended. In some embodiments, a custom leaderboard for a particular challenge can be managed by the challenging user's computing device. The gaming application can be implemented in software, hardware or a combination thereof.

The challenge type provided in field **424** indicates a type of challenge for the challenge being created. The challenge type can be time-based, objective-based, tournament or another challenge type. Time-based challenges include, for example, the fastest lap or overall time for a racing game, or the time it takes a user to complete a level, quest, mission or the like. Time-based challenges can be an absolute time challenge (e.g., a specific time that participants are to beat in order to win the challenge) or a relative time challenge (e.g., the user having the best time when the challenge expires wins the challenge). Objective-based challenges include, for example, the first user to complete a level, defeat an opponent, collect an item, achieve a particular ranking level or beat the challenging user's current score, ranking. Objective-based challenges can be absolute (e.g., the first user to achieve the objective wins the challenge) or relative (e.g., the user that achieves the highest ranking, score, etc. by the end of the challenge wins the challenge). In some embodiments, the challenge type can be used to restrict the possible values for other fields in user interface **402** and other challenge criteria. For example, selecting "time-based" as the challenge type can cause the leaderboard to be restricted to leaderboards that keep track of time-related metrics for the selected gaming application.

In a tournament challenge, participants are paired off to compete in individual head-to-head challenges (matches) to determine a tournament winner. The individual matches within a tournament can be of any challenge type and the tournament can follow a single-, double- or triple-elimination, or any other tournament format. Initial tournament match-ups can be generated randomly, based on current leaderboard rankings (e.g., the two users having the highest current ranking are matched, the users having the next two highest rankings are paired, etc.; or, the top-ranked user is paired against the lowest ranked pair, the next-highest ranked user is paired against the next-lowest ranked user, etc.) or in other fashions.

Management of a tournament can be performed, for example, by challenger or challengee computing devices. For example, in one embodiment, a challenger computing device can manage the tournament by performing tournament tasks such as determining which pairs of users are to be paired off in the individual matches, determining winners of individual matches, and determining the tournament winner. Challengee computing devices can send information to the challenger computing device to provide information to support these tasks. In some embodiments, a gaming service can be responsible for managing at least a part of a tournament challenge.

In one example of a tournament challenge, Abe creates a single-elimination tournament challenge in which Bill, Cindy and Dave are participants. Abe creates the tournament challenge on his smartphone on April 26 at 1:00 PM. Abe's smartphone transmits the tournament request to a gaming service that creates the first round of tournament pairings randomly. The gaming service creates private leaderboards for the tournament matches. The private leaderboards can be updated only by the match participants and the match participants start with no ranking within the private leaderboard. The private leaderboard can have an expiration time (i.e., a challenge duration time for the individual matches within the tournament) after which the private leaderboard cannot be updated.

As the tournament is played, the gaming service can send challenge update notifications to tournament participants containing information from the individual challenges (e.g., leaderboard ranking information for the individual match-ups, the results of the individual matches) plus information about which participants are paired. If there is an odd number of participants, one participant can be randomly selected to receive a bye (i.e., automatically makes it to the next round of pairings and is guaranteed to be paired up in the next round).

In a tournament challenge, a user interface can be displayed showing a tournament bracket filled out to the extent that tournament matches have been completed.

Continuing with the tournament example, the results from the first round of matches can be determined, for example, 24 hours after the matches started, at 1:00 PM on April 27 (other challenge duration lengths could be chosen). The gaming service can check results at 1:00 PM on April 27 by performing the following (alternatively, matches can be checked to see if they have ended when a participant accesses the gaming application or when a player's game metric for the leaderboard is sent to the gaming service to update the leaderboard):

1. Check the private leaderboard for the current match.

2. Where the gaming service has paired up Abe vs. Bill and Cindy vs. Dave in the first round, Abe's ranking is compared to Bill's ranking, and Cindy's ranking is compared to Dave's ranking on the associated private leaderboards, and match winners are advanced to the next round. The losing users are eliminated from the tournament. The gaming service can retain private leaderboards for matches in the tournament for at least the duration of the tournament.

3. Determine pairings for the next round of the tournament, or complete the tournament if there are no rounds left.

4. Send a challenge update notification to tournament participants notifying them that the results of current round are in. For example, a challenge update notification can cause a toast notification to be presented that states "Round 1 tournament results are in!"

5. A user tapping on the toast message or the corresponding notification can cause a display to be presented with current and past results that have been generated thus far for the tournament.

6. In response to a user tapping on a particular match a display can be shown with avatars for the match participants animated according to the outcome for the match. FIG. **17** shows one such exemplary display **1700**. The winning user's avatar **1710** is animated with a positive expression and a losing user's avatar **1720** is animated with a negative expression. Actions **1** through **6** can be repeated until all but one tournament participants have been eliminated.

Returning to FIG. **4**B, the challenge duration provided in field **426** indicates how long a challenge is to last. The challenge can begin when a challenge request notification is transmitted from a challenger computing device; upon acceptance of the challenge by a first challengee, a specified number of challengees, or all challengees; when the game specified in the gaming application is first played by a challengee; or other event. Alternatively, the challenge duration can specify a relative date such as "this Friday", "the end of next week" or a specific date, e.g., "May 10." In some embodiments, a challenger can specify start and end times for a challenge.

The leaderboard specified in the field **428** is a leaderboard associated with the gaming application specified in field **420**. A leaderboard comprises an ordered list of a plurality of users that have played the game. A particular leaderboard can be ordered according to a particular metric (game metric) associated with the gaming application. A user's rank is their position within a leaderboard. A user's rank can be absolute (i.e., their position relative to all other users in a leaderboard) or relative (i.e., their position relative to other challenge participants within a leaderboard). Various game metrics that can be tracked by a leaderboard include scores (e.g., high score for a game or a level within a game), time (e.g., fastest overall time, fastest lap time), rank, milestone or objective reached (e.g., completion of a quest, treasure collected, enemy vanquished). Separate leaderboards can be associated with individual levels, courses, quests, missions, difficulty level and the like. The leaderboards can have a "friendly name" that allows them to be easily identified by a user (e.g., "Extreme Motocross—Race Course A—Beginner"). In some embodiments, the leaderboard identified in challenge information for a challenge is an existing leaderboard already being maintained by a gaming service or other entity. In various embodiments, a custom leaderboard can be created and managed for an individual challenge. Custom leaderboards can be maintained at a challenger or challengee computing device, or by a gaming service. If custom leaderboards are created, user interface **402** can provide a field in which a challenger specifies the gaming metric the custom leaderboard is to track.

Not all of the fields shown in the user interface **402** need be specified for every challenge. For example, in some challenges, a leaderboard may not be specified. For example, in an objective-based challenge, where the challenger specifies that a particular item is to be unlocked or acquired in an additional challenge criterion field, there may not be a leaderboard maintained by a gaming service that tracks whether players having unlocked that particular item.

Challengees can be identified in field **430** with user-identifying information such as a gaming service userid or other user identification information such as an email address or phone number. For example, if the gaming service is the Xbox LIVE® service, the challenged users can be identified by their Xbox LIVE® userid.

FIG. **4**C shows a user interface **403** that prompts a challenger for information during creation of a challenge. The user interface **403** comprises a challenge message window **440** in which the challenger can enter a personalized message to be included in a challenge request presented to a challenged user (e.g., "I challenge you to beat my fastest time in Extreme Motocross!"). The user interface **403** further comprises an avatar **442** of the challenger that can be animated according to an expression specified by the challenger. The avatar **442** can be an avatar that the challenger has set up through the gaming service or at the challenger computing device. Selection of an avatar expression button **444** can bring up a list of avatar expressions for the challenger to select from to indicate how the avatar is to be animated in the challenge request. These expressions can animate the avatar as being excited, tough, confident, happy, sad, frustrated or in any other manner, or indicate a gesture or action that avatar is to perform such dancing, jumping, folding arms or pointing. If no avatar expression is indicated, the avatar can be animated in a challenge request according to a default expression or not be animated at all.

In some embodiments, avatar expression information can comprise information indicating a mood, feeling, emotion or action that a computing device can use to determine how an avatar is to animated. For example, upon determining that avatar expression information indicates that an avatar is to be animated as confident, the computing device knows to animate the avatar in a sequence in which the avatar crosses its arms, puffs out its chest and stands tall. The information used by the computing device to animate an avatar in accordance with a designated expression can be stored locally at the computing device. In various embodiments, avatar expression information can comprise information on how an avatar is to be animated, without reference to a mood, feeling, emotion or action. For example, avatar expression information can comprise information indicating how an avatar is to move in a series of avatar images, such as frame model information for the avatar, indicating how the avatar is to be rendering in a series of images.

In some embodiments, the message window **440** can be pre-populated with a message based on challenge informa-

tion already supplied by the user (e.g., supplied in user interface **402**). One example of a pre-populated message is "I challenge you to have the higher ranking on the <leaderboard-FriendlyName> leaderboard by <DateTimeNow+NDays>. My current rank is <rank> with <rating>," where <leaderboardFriendlyName> is the friendly name of the leaderboard, <DateTimeNow> is the current time, <NDays> is the duration of challenge specified in days, <rank> is the rank of the challenging user within the leaderboard, and <rating> is the current rating of the user. A pre-populated message can be edited or replaced with a custom message entered by the challenger.

In some embodiments, the message window **440** can be pre-populated with a message based on a challenge history between a challenger and a particular challengee. The pre-populated message can consider the time and/or the outcome of prior challenges between the two users. For example, if a challenger has recently lost to a challengee they are challenging again, the pre-populated message could be "Give me a chance to win back my honor!" In another example, if a challenger has won every challenge issued to challengees in a particular game (or won the most recent n challenges in a row), the message window **440** could be pre-populated with "I am unbeatable! I challenge you to try again and take my place as Rank #1 in <game> leaderboard." where <game> is the gaming application specified in the gaming challenge. Challenge history information can be stored in a challenge store stored locally at a client computing device, or centrally at a gaming service.

The user interface **403** further comprises userids of one or more challengees, the name of the gaming application, a thumbnail image **445** of the gaming application, and additional information **446** comprising the challenge name, challenge type and duration. The user interface **403** can have more or less information than that shown. In some embodiments, different avatar expressions and challenge messages can be provided for different challengees.

After the challenge has been created at the challenger's computing device **310**, challenge information **340** is sent from the computing device **310** to the gaming service **320**, to be forwarded onward to the challenged user's computing device **330**. The challenge information **340** can be sent as part of a challenge notification. The challenge information **340** can include one or more of the following: participant information identifying the challenger and challengees, game information identifying the gaming application to be played as part of the gaming challenge, leaderboard information indicating the leaderboard associated with the gaming application to be used in determining in determining a challenge winner, a challenge message, and challenger avatar expression information.

In some embodiments, a challenge can be issued via a challenge notification that is added to a challengee's notification queue within a gaming service. In other embodiments, challenge information can be sent to a challengee via email, MMS, a social media network or in another manner.

FIG. **5** is an exemplary flowchart **500** for sending and receiving a gaming challenge. At **510**, a challenge is created by a challenger. At **520**, it is determined, for the individual challengees, whether the challengee is a friend of the challenger within a gaming service, community, environment or the like. For example, if the gaming service is the Xbox LIVE® service, it can be determined at **520** whether a challengee is a friend of the challenger within the Xbox LIVE® service. If the challengee is a friend, at **530**, a notification is sent to the challengee's account, and, at **540**, a challenge notification is added to the challengee's account. Regardless of whether a particular challengee is a friend, at **535** a challenge notification is sent to the challengee's email address (or phone number (if an MMS notification is sent), social media network userid, etc.) and a challenge email is received in the challengee's email inbox at **545** (or at the challengee's smartphone if sent by MMS, or social media network messaging system inbox).

FIGS. **6**A-**6**D show exemplary user interfaces **601**-**604** that can be displayed at a computing device as part of creating a gaming challenge within the context of the gaming application. User interface **601** shows a button **610** that a user can select to create a challenge involving the gaming application currently being executed on the computing device. Selecting the button **610** can cause user interface **602** to be displayed, which is similar to user interface **401**, for the collection of challenge information. The game field can be auto-filled with the name of the gaming application. By advancing to user interface **603**, by, for example, tapping a "next screen" button **620**, a user can enter a challenge message and indicate a challenger avatar expression for the challenge request. By tapping a point on the computing device display within the challenge message window **630**, an on-screen keyboard **640** (shown in user interface **604**) can appear that allows a user to compose a custom challenge message **650**, as shown in display **604**.

FIGS. **7**A-**7**F show exemplary user interfaces **701**-**706** that can be displayed at a computing device as part of creating a gaming challenge. The user interfaces **701**-**706** allow a user to select various gaming challenge parameters (e.g., gaming application, challenge type) instead of entering the information manually. The user interfaces **701**-**706** can be presented, for example, in response to one of the fields in user interface **401** in FIG. **4**B or **601** in FIG. **6**A being selected. For example, the user interface **701** can be displayed in response to a challenger tapping the "game" field in either user interface **401** or **601**. The user interface **701** displays a list of games **710** for which the gaming service maintains at least one leaderboard, and a list of games **720** for which the gaming service does not maintain leaderboards.

FIG. **7**B shows a user interface **702** in which a user can manually enter the name of a challenge. FIG. **7**C shows a user interface **703** comprising a list of challenge types **730** (time, objective, tournament) from which a user can select for a new challenge. In some embodiments, selection of one of the listed challenge types can cause another user interface to be displayed in which a challenge sub-type can be selected. For example, selection of the "time" challenge type can cause a challenge sub-type user interface to be presented listing time-based challenge sub-types such as "total time," "lap time," "level time" and the like. FIG. **7**D shows a user interface **704** comprising a list of challenge durations **740** that a user can select from to indicate a challenge duration. Selection of a "custom" duration can allow a user to enter a custom duration, and selecting "date" can allow a user to indicate a specific date on which the challenge ends or a start and stop date for the challenge.

FIG. **7**E shows a user interface **705** in which a user can select challengees for a challenge. The user interface **705** comprises a list of recent friends (or challengees) **750** that a user can select from. Clicking on the "Xbox LIVE friends" user interface element **760** can cause an additional user interface (not shown) to be presented that allows the user to select from the user's friends with the Xbox LIVE® (or other) gaming service. Selection of the "contacts" user interface element **770** can cause the user interface **706** to be presented, which comprises a list of contacts **780** from the user's list of contacts stored locally or accessible by the computing device.

Returning to FIG. **3**, after challenge information **340** has been transmitted to the challengee computing device **330**, the challengee computing device **330** can cause a challenge notification to be output at a display of the device **330**. In one embodiment, a temporary pop-up or toast user interface element comprising information indicating that a gaming challenge has been issued to the challenged user can be displayed. Selecting (e.g., clicking or tapping) the temporary pop-up or toast UI element can cause an interstitial page to be displayed.

FIG. **8** shows an exemplary interstitial page **800** that can be presented at a computing device as part of presenting a challenge request. The page **800** comprises challenger participant information (e.g., challenger userid "gamertag123") **810**, a challenge message **820**, a thumbnail image **830** of the gaming application selected for the challenge and an avatar **840** of the challenger. The avatar **840** can be animated according to challenger avatar expression information included in the received challenged information **340**. If no avatar expression was selected by the challenging user, the avatar **840** can be animated according to a default animation, or the avatar can be unanimated. The avatar can be a 2D or 3D avatar. The interstitial page **800** further comprises an "accept" button **850** for accepting the challenge, a "not now" button **860** to dismiss the notification and cause the challenge request to be presented at a later time, and a button **870** that displays additional challenge information. In some embodiments, the page **800** can comprise a "decline" button that allows a challengee to decline the challenge.

In response to a challengee accepting or declining the challenge, accept/decline information **350** can be transmitted from the challengee computing device **330** to the gaming service **320**, which relays the accept/decline information **350** to the challenger computing device **310**. In response to receiving the accept/decline information **350** at the device **310**, an acceptance or decline notification can be presented at the device **310**. In some embodiments, when accepting or declining a challenge request at the challengee computing device **330**, a challengee can compose a challenge response message and select a challengee avatar expression. The challenge response message and the challengee avatar expression information can be included in the accept/decline information **350**. When a challenge acceptance or decline notification is presented at the challenger computing device **310**, the challenge response message is presented and a challengee avatar can be animated according to the challengee avatar expression information. After a challenge notice sent to a challengee's gaming service account has been accepted or declined, the challenge notice can be deleted from the challengee's gaming service account.

Once a challenge has begun, the current status of a challenge can be determined based on the leaderboard selected for the challenge. As challenge participants play the game associated with the challenge, their position on the leaderboard is updated as the player progresses through or otherwise plays the game. Updated game metrics for challenge participants are transmitted to the gaming service as the participants complete a portion of a game (e.g., complete a race, defeat a level boss, finish a quest), when a participant starts or exits a gaming application, on a periodic or other time basis, or at any other time.

Returning to FIG. **3**, a computing device can transmit a leaderboard ranking request **360** to the gaming service **320** to update the challenge status. The leaderboard ranking request **360** can comprise leaderboard information identifying a leaderboard associated with a gaming challenge. In return, the gaming service **320** can transmit leaderboard ranking information **370** back to the requesting computing device. In some embodiments, the leaderboard ranking information **370** comprises ranking information for users in a leaderboard regardless of whether they are participants to the active challenge. In other embodiments, the leaderboard ranking information **370** comprises leaderboard ranking information only for challenge participants. In the latter case, the leaderboard request information **360** can comprise participant information identifying the challenge participants. In response to receiving the leaderboard ranking information **370**, a computing device can update challenge status indicators for active challenges (e.g., indicator **410**), update a locally stored challenge record corresponding to the challenge, as discussed below, and present a display indicating the relative rankings of challenge participants.

FIGS. **9A-9C** show exemplary user interfaces **901-903** that can be displayed at a computing device for navigating to a particular leaderboard and to show the relative rankings of challenge participants. User interface **901** shows a list of games **910** for which a particular gaming service (e.g., Xbox LIVE®) maintains at least one leaderboard. Selecting a particular game within the list **910** causes the user interface **902** to be presented, which comprises a list **920** of leaderboards that the gaming service maintains for the selected game. Selection of a particular leaderboard within the list **920** causes the user interface **903** to be presented at the computing device output in which the relative rankings for users are displayed. The display **903** comprises the name of the gaming application, the leaderboard name, and a podium image **930** showing avatars and userids of the three users atop the selected leaderboard. The users shown in the podium graphic can be top three users atop the leaderboard (regardless of whether they are challenge participants), or the top three ranked challenge participants in the leaderboard. Challenge participant rankings can be shown in other forms, such as in a list.

FIG. **10** shows a first exemplary flow of information **1000** between a client computing device **1010** and a cloud-based gaming service **1020**. The information received by the client computing device **1010** can be used to generate the exemplary user interfaces **901-903**. First, the client computing device **1010** requests a list of games for which the gaming service **1020** manages at least one leaderboard. In some embodiments, the device **1010** can request the last n games that a user has played. Second, the gaming service **1020** returns gaming information. Third, the client computing device **1010** requests leaderboards for the games identified in the gaming information. Fourth, the gaming service **1020** returns leaderboard information for leaderboards associated with the games. The returned leaderboard information for a leaderboard can comprise a leaderboard identifier that uniquely identifies the leaderboard within the gaming service **1020** and a leaderboard friendly name (e.g., "Warrior World—Top Scores"). Fifth, the gaming information can be used to generate a list of games having at least one leaderboard supported by a gaming service, such as the list **910** in user interface **901**. Games that do not have at least one leaderboard can be left out of the list **910**. Sixth, after a game is selected by a user, the leaderboard information can be used to generate a list of the leaderboards associated with the selected game, such as the list **920** in the user interface **902**.

FIG. **11** shows exemplary leaderboard information **1100** that can be transmitted from the gaming service **1020** to the client computing device **1010**. The exemplary leaderboard information **1100** comprises a "leaderboards" data structure comprising data for leaderboards **1110**, **1120** and **1130**. For an individual leaderboard, the data structure comprises an "lbid" leaderboard id field that uniquely identifies the leader-

board to the gaming service, a "name" field that includes a leaderboard language and a leaderboard friendly name, and a "rating" field that includes a leaderboard language and a rating type indicating how leaderboard information is to be interpreted and displayed. For example, the "TimeColumn" rating type for leaderboards **1120** and **1130** can indicate that leaderboard data for these leaderboards are to be interpreted as a time and that the leaderboard is to be displayed in columns. The leaderboard information **1100** further includes a "primaryid" field that indicates which leaderboard is to be displayed as a default leaderboard, and a "titleid" that uniquely identifies the game associated with the leaderboards within a gaming service.

FIG. **12** shows a second exemplary flow of information **1200** between a client computing device **1210** and a gaming service **1220**. The information received by the client computing device **1210** can be used to generate the exemplary leaderboard display **903**. First, the client computing device **1210** requests ranking information for a particular leaderboard. Second, the gaming service returns the requested leaderboard ranking information.

FIG. **13** shows exemplary leaderboard ranking information **1300** that can be transmitted from the gaming service **1220** to the client computing device **1210**. The exemplary leaderboard information **1300** comprises a "lbname" leaderboard name field, a "pagingInfo" field that indicates, if the leaderboard comprises multiple pages, the leaderboard page being sent ("continuationToken") and the maximum number of pages ("totalItems"); a "rating" field indicating how the leaderboard is being rated (e.g., by duration), and a "userList" data structure comprising information for various users ranked in the leaderboard. The "userList" data structure comprises a "gamertag" field containing a user's userid or tag within the gaming service (e.g., "CriticalSTRo77"), a "rank" field indicating a user's rank within the leaderboard, a "rating" field indicating the game metric by which users are ranked in the leaderboard (in this example, time), and a "xuid" user identification field that uniquely identifies a user within the gaming service.

Once a challenge has begun, the technologies described herein can monitor progress of active gaming challenges. Returning to FIG. **3**, after the computing device **310** or **330** has received leaderboard ranking information **370**, the device **310** or **330** can determine whether a challenge participant's ranking has changed relative to any of the other challenge participants, based on the current value of the player's game metric being monitored by the leaderboard. For example, if computing device **310** is used by user A, who has challenged other users to a gaming challenge that utilizes the high score leaderboard for Game X, and leaderboard ranking information received from the gaming service **320** indicates that user A is currently second in the challenge, the computing device **310** may determine that user A's current score would currently place him first. In response, the computing device **310** can issue a challenge rank change notification **380** to the gaming service **320** to be passed to other participants to the challenge. The challenge rank change notification **380** can comprise user identification information for the other challenge participants and user A's current score for Game X. The gaming service **320** can update the Game X high score leaderboard with user A's current high score and issue a challenge rank change notification **380** to computing devices **330** of other challengees.

Upon receipt of a challenge rank change notification, a computing device can display a notification at the display of the computing device notifying the user of the rank change. A user can personalize a computing device's challenge settings so that the user is notified of all challenge rank changes, or only particular rank changes, such as when only the user of the computing device's relative ranking has changed, when the top position has changed, when any of the top n positions have changed, or when there is a rank change within the last minute, hour or other time prior to expiration of the challenge.

In some embodiments, a computing device can store challenge information locally. FIG. **14** shows an exemplary challenge store **1410** that can be stored at a computing device. In some embodiments, the challenge store **1410** is stored externally to a computing device, such as at an attached memory storage device or a memory accessible over a network (e.g., at a cloud-based service such as a gaming service). The challenge store **1410** comprises one or more challenge records **1420**. A challenge record **1420** can comprises one or more of the following: participant information **1430** indicating identifying information for challenge participants (e.g., userids within a gaming service), leaderboard information **1440** identifying the leaderboard to be used in a challenge, game information **1450** identifying the gaming application to be played in the challenge, duration information **1460** indicating the duration of the challenge, and challenge criteria information **1470** containing additional information about the gaming challenge such as a challenge award; and/or particular course, level or difficulty level within the gaming application. Additional information that can be stored in a challenge record **1420** includes whether the challenge is an active or past (i.e., completed) challenge.

The challenge store **1400** can further comprise challenge history information **1480** for one or more other users. Challenge history information **1480** can comprise information indicating how the user of the computing device storing the challenge store **1410** has fared against other users in prior challenges, such as a current win or loss streak against the another user, information about the outcome of challenges involving other users such whether the user finished ahead of the other user in prior challenges, etc.

Upon receipt of a challenge rank change notification, a computing device can compare the information in the ranking change notification against the associated local challenge record before displaying a challenge rank change notification, thus avoid notifying a user of a particular rank change more than once. For example, in a challenge comprising three users, two computing devices can issue a challenge rank change notification to challenge participants indicating that user B has passed user C. The third computing device, upon receiving the first challenge rank change notification, updates the challenge record to reflect that user B is now ahead of user C, and displays a notice informing the user of this rank change. Upon receiving the second challenge rank change notification containing the same information, that user B has passed user C, the third computing device determines that this information is consistent with the challenge information stored locally, and does not present a change rank notice.

FIGS. **15**A and **15**B show exemplary user interfaces **1510** and **1520** that display a leaderboard of a current challenge. Navigating to a challenge component of a computing device operating system can cause a user interface **1510** to be output at a computing display. The user interface **1510** comprises a list of current challenges **1512**. Selecting one of the current challenges can cause the user interface **1520** to be output at the device. The display **1520** can comprise information about the selected active challenge such as the challenge name **1522**, the challenge type **1524**, the challenge duration **1526** and information indicating the rankings of participants to the challenge. The user interface **1520** comprises a podium view **1528** of the three challenge participants that are currently

leading the challenge. The podium view **1528** comprises the participants' avatars and userids. The rankings of the challenge participants can be displayed in various other manners (e.g., a list) and more or fewer than three participants can be shown in the ranked display. The user interface **1520** comprises a refresh button **1544** that causes the leaderboard to be refreshed. Refreshing the leaderboard can cause the computing device to transmit and leaderboard ranking information request to the gaming service and receive leaderboard ranking information in response, which is then used to present an updated leaderboard view.

In addition to being able to see a ranked view of the top ranked participants in a challenge, challenge participants can access a participants' view that displays user information for other participants to the challenge. The participants view can include, for example, a list of all users that were invited to participate in the challenge, or only the users that accepted the challenge. If participants that declined the challenge invitation are listed, they can be listed in order by, for example, the time when the invitation was declined. Additionally, a user element indicator (e.g., a graphic element) can be shown next to users that declined the challenge invitation indicating that they declined the challenge.

The technologies disclosed herein are also capable of determining when a challenge has ended. A challenge can end for various reasons, such as when the challenge has been met by one of the challenge participants (e.g., a user has reached a specified score, beat a specified time, finished a specified challenge, obtained a specified item or specified number of specified items) or that the challenge has expired. Upon expiration of a time-based relative challenge, the challenging computing device can determine the challenge winner based on which participant has the highest leaderboard ranking upon expiration of the challenge. An objective-based challenge can have no winner if no participant has reached a specified goal when the challenge expires.

A computing device can check to see whether challenge criteria has been met when, for example, the gaming application sends a user's gaming metric to a gaming service to update a leaderboard. Alternatively, gaming applications can be configured to pass information to a challenge component of the computing device operating system whenever a user finishes a race, quest, mission or objective. When a computing device determines that a challenge has ended, the computing device can send a challenge end notification to the other challenge participants. Returning to FIG. **3**, if, for example, in a gaming challenge where the first user to finish a course under two minutes wins the challenge, and the challengee operating computing device **330** finishes the designated course in 1:53, the computing device **330** sends a challenge end notification **390** to the gaming service **320**. The gaming service **320** relays the challenge end notification **390** to the challenger computing device **310** and other challengee computing devices **330**.

Upon the completion of a challenge, a computing device can update the corresponding challenge record in its challenge store to indicate that the challenge is no longer active. In addition, the computing device can transmit a final leaderboard information request to the gaming service to receive final leaderboard ranking information. The challenge record for the completed challenge can be updated based on the final ranking information and the challenge history information for challenge participants can be updated based on the results of the completed challenge as well.

FIG. **16** shows exemplary user interfaces **1601**-**1603** for managing challenges. User interface **1601** shows a list of active challenges **1610** and a list of past challenges **1612**. The active challenges can be challenges that have not yet been accepted by the user, or challenges that have been accepted and are in progress. The user interface **1602** shows lists of active and past challenges with checkboxes **1620** that can be selected by a user to mark challenges for deletion. Display **1602** shows the second and fourth active challenges selected for deletion. A user can delete the marked challenges by selecting the trash can button **1622**. The user interface **1603** shows an updated active challenge list **1630** after the trash can button **1622** has been selected. In some embodiments, challenges that a user has not accepted or declined can remain stored at a computing device for a default period of time (e.g., 1 week, 1 month) after which it is deleted. A user can withdraw from a challenge that the user has previously accepted by deleting the on-going challenge.

FIG. **18** is a flowchart of an exemplary method **1800** of issuing a gaming challenge. The exemplary method **1800** can be performed by, for example, a smartphone operated by user A and capable of communicating with the Xbox LIVE® service. At **1810**, at a client computing device, challenge information is transmitted for receipt at a gaming service. The challenge information comprises participant information identifying a plurality of challenge participants, the challenge participants comprising a challenger and one or more challengees; game information identifying a gaming application to be played as part of the gaming challenge; and leaderboard information identifying a leaderboard associated with the gaming application, the leaderboard ranking users according to a game metric associated with the gaming application. In the example, the smartphone transmits challenge information to the Xbox LIVE® service. The challenge information comprises information indicating that user A, the challenger, and user B, the challengee, are participants to the challenge; that the game Racer X is the gaming application that is to be played as part of the gaming challenge, and that the leaderboard titled "Racer X—Fastest Lap—Couse 1" is the leaderboard to be used in determining the winner of the challenge.

At **1820**, challenge response information is received comprising information indicating that a responding challengee has been accepted or declined the gaming challenge and challengee avatar expression information. In the example, the smartphone receives challenge response information comprising information indicating that user B has accepted the challenge and user B avatar expression information indicating that user B's avatar is to be expressed as confident when the acceptance is output at the display of user A's smartphone. At **1830**, a user interface is output at the client computing device comprising information indicating that the responding challengee has accepted or declined the gaming challenge and a responding challengee avatar animated according to the challengee avatar expression information. In the example, a user interface showing user B's acceptance of the challenge is displayed at the smartphone, along with an avatar of user B animated as being boastful.

At **1840**, leaderboard ranking information is received from the gaming service indicating a rank within the leaderboard for at least two of the challenge participants. In the example, leaderboard ranking information is received from the Xbox LIVE® service indicating that users A and B are ranked fourth and tenth, respectively, in the "Racer X—Fastest Lap—Course 1" leaderboard. At **1850**, information is output at a display of the client computing device indicating relative rankings within the leaderboard for the at least two challenge participants. In the example, a podium image is displayed at the smartphone display showing user A ranked first and user B ranked second.

The method **1800** can comprise more or fewer process blocks than those shown in FIG. **18**. For example, the method **1800** can exclude process blocks **1820**, **1830**, **1840** and **1850**, or exclude process blocks **1840** and **1850**. In other embodiments, the method **1800** can comprise additional actions performed by a client computing device participating in a challenge, as described herein.

FIG. **19** is a flowchart of an exemplary method **1900** of accepting a gaming challenge. The method **1900** can be performed by, for example, a smartphone operated by user C and capable of communicating with a gaming service. At **1910**, challenge information is received at a client computing device from a gaming service. The challenge information comprises: participant information identifying a challenger and one or more challengees; game information identifying a gaming application to be played as part of the gaming challenge; leaderboard information identifying a leaderboard associated with the gaming application, the leaderboard ranking users according to a game metric associated with the gaming application; and challenger avatar expression information. In the example, the smartphone receives challenge information comprising participant information identifying user A as the challenger and users B and C as challengees, game information identifying "Universe of Monsters" as the gaming application to be played, leaderboard information identifying "Universe of Monsters—Player Level" as the leaderboard to be used in determining whether the challenge has been met, and challenger avatar expression information indicating that the user A's avatar is to be expressed as "arrogant" when a challenge request is presented to the user C.

At **1920**, a challenge request is output at a display of the client computing device. The output comprises animating a challenger avatar according to the challenger avatar expression information. In the example, a challenge request is output at the smartphone display comprising user A's avatar animated as being arrogant.

At **1930**, leaderboard ranking information is received from the gaming service indicating a rank within the leaderboard for at least two of the challenge participants. In the example, the smartphone receives leaderboard ranking information indicating the users A, B and C are ranked 40^{th}, 200^{th} and 105^{th} in the "Universe of Monsters—Player Level" leaderboard.

At **1940**, it is determined that a rank of the challengee using the client computing device within the leaderboard has changed relative to the rank of at least one of the other challenge participants. In the example, the smartphone determines that user C has fallen behind user B in the leaderboard ranking. This can be based on a challenge record stored at the smartphone that indicated that user C was previously ranked 350^{th}. At **1950**, a challenge rank change notification is transmitted to the gaming service indicating that the rank of the challengee using the client computing device has changed relative to the rank of at least one of the other challenge participants. In the example, the smartphone transmits a challenge rank change notification to the gaming service indicating that user C has passed user B in the "Universe of Monsters—Player level" leaderboard.

The method **1900** can comprise more or fewer process blocks than those shown in FIG. **19**. For example, the method **1900** can exclude of process block **1920**, **1930**, **1940** and **1950**, or exclude process blocks **1940** and **1950**. In other embodiments, the method **1900** can comprise additional actions performed by a client computing device participating in a challenge, as described herein.

The disclosed technologies have at least the following exemplary advantages. The challenge technologies can turn single-player gaming applications into multi-player gaming applications without requiring modifications to the single-player gaming applications. As used herein, the term "single-player" game includes multi-player games that have a single-player mode. While participating in a challenge, a user can play a single-player gaming application just as if he or she were not participating in a challenge. The challenge features of a computing device operating system can manage challenge-related operations at the computing device, such as creating a challenge; generation, transmitting, receiving and processing of challenge notifications (e.g., challenge rank change notifications, challenge end notifications); determining when a challenge has expired (by determining that challenge criteria have been satisfied or a challenge has expired); managing a challenge store; requesting leaderboard ranking information and the like. The gaming challenges disclosed herein are not limited to single-player gaming applications and can involve the playing of multi-player gaming applications.

In some embodiments, the challenge features of a computing device operating system can be configured to interact with gaming applications that have been modified to support challenges. For example, a particular gaming application can be informed by the operating system of active challenges involving the gaming application and various challenge criteria that needs to be satisfied in order for the challenge to be met, and the application can inform the operating system when a specified objective has been obtained (e.g., a level completed, an object acquired, an opponent defeated), a specified objective time on a particular course has been bested, or other challenge criteria satisfied.

Gaming applications can be configured to support challenges in other ways. For example, in a time-based challenge in a racing game application where a user can race against opponents controlled by the application, one or more "pacing" opponents can be generated that finish the course at a time specified in the challenge as the time to beat in order to win the challenge, or the best time for other challenge participants. The pacing opponent can be distinguished from other application-controlled opponents by a specific color, marking, symbol or graphic image that tracks the pacing opponent so that the user which opponent he or she needs to beat in order to win the challenge (or move up in the rankings). The pace of the pacing opponent can change during the challenge as the time of the top-ranked participant improves, or the time of other challenge participants improves. In objective-based challenges, the application can provide a notification or indicate that a particular level, mission, quest, task, object or opponent is to be obtained, completed or finished in order to meet a challenge. This can be done by, for example, highlighting a mission, task or level or adding the word "challenge" (or an equivalent) in a list when the user is selecting a portion of the game to play, or giving an object or an opponent a special or different color or marking.

In addition, by utilizing a leaderboard managed by a gaming service in determining whether a challenge is met, the challenge technologies can have the advantage of leveraging existing gaming service infrastructure. The leaderboard ranking information requests transmitted to a gaming service by a computing device can follow existing leaderboard ranking information request formats so that no modifications to the gaming service are required. In addition, a gaming service's in-service messaging system can be utilized to pass challenge-based messages and notifications between challenge participants. As discussed herein, a gaming service can be configured to support challenge features. For example, a gaming service can be modified to support custom leaderboards

for individual challenges or to support various aspects of tournament challenges as described herein.

In one exemplary embodiment of a method of issuing a gaming challenge, the method comprises: at a client computing device, transmitting challenge information for receipt at a gaming service, the challenge information comprising: participant information identifying a plurality of challenge participants, the challenge participants comprising a challenger and one or more challengees; game information identifying a gaming application to be played as part of the gaming challenge; and challenge criteria information indicating one or more challenge criteria that are to be satisfied for the gaming challenge to have been met by a challenge participant.

Any of the disclosed methods can be implemented as computer-executable instructions or a computer program product. Such instructions can cause a computer to perform any of the disclosed methods. The computer-executable instructions or computer program products as well as any data created and used during implementation of the disclosed embodiments can be stored on one or more computer-readable storage media (e.g., non-transitory computer-readable storage media, such as one or more optical media discs (such as DVDs or CDs), volatile memory components (such as DRAM or SRAM), or nonvolatile memory components (such as flash memory or hard drives)) and executed on a computer (e.g., any commercially available computer, including smart phones or other computing devices that include computing hardware). Computer-readable storage media does not include propagated signals. The computer-executable instructions can be part of, for example, a dedicated software application or a software application that is accessed or downloaded via a web browser or other software application (such as a remote computing application). Such software can be executed, for example, on a single local computer (e.g., any suitable commercially available computer) or in a network environment (e.g., via the Internet, a wide-area network, a local-area network, a client-server network (such as a cloud computing network), or other such network) using one or more network computers.

For clarity, only certain selected aspects of the software-based implementations are described. Other details that are known in the art are omitted. For example, it is to be understood that the disclosed technology is not limited to any specific computer language or program. For instance, the disclosed technology can be implemented by software written in C++, Java, Perl, JavaScript, Adobe Flash, or any other suitable programming language. Likewise, the disclosed technology is not limited to any particular computer or type of hardware. Certain details of suitable computers and hardware are well known and need not be set forth in detail in this disclosure.

Furthermore, any of the software-based embodiments (comprising, for example, computer-executable instructions for causing a computer to perform any of the disclosed methods) can be uploaded, downloaded, or remotely accessed through a suitable communication means. Such suitable communication means include, for example, the Internet, the World Wide Web, an intranet, cable (including fiber optic cable), magnetic communications, electromagnetic communications (including RF, microwave, and infrared communications), electronic communications, or other such communication means.

Any of the methods described herein can be implemented by computer-executable instructions stored in one or more computer-readable storage devices (e.g., hard disk drives, floppy disk drives, memory integrated circuits, memory modules, solid-state drives and other devices comprising computer-readable storage media). Such instructions can cause a computer to perform the methods described herein.

As used in this application and in the claims, the singular forms "a," "an," and "the" include the plural forms unless the context clearly dictates otherwise. Similarly, the word "or" is intended to include "and" unless the context clearly indicates otherwise. The term "comprising" means "including;" hence, "comprising A or B" means including A or B, as well as A and B together. Additionally, the term "includes" means "comprises."

The disclosed methods, apparatuses, and systems should not be construed as limiting in any way. Instead, the present disclosure is directed toward all novel and nonobvious features and aspects of the various disclosed embodiments, alone and in various combinations and subcombinations with one another. The disclosed methods, apparatuses, and systems are not limited to any specific aspect or feature or combination thereof, nor do the disclosed embodiments require that any one or more specific advantages be present or problems be solved.

Theories of operation, scientific principles or other theoretical descriptions presented herein in reference to the apparatuses or methods of this disclosure have been provided for the purposes of better understanding and are not intended to be limiting in scope. The apparatuses and methods in the appended claims are not limited to those apparatuses and methods that function in the manner described by such theories of operation.

Although the operations of some of the disclosed methods are described in a particular, sequential order for convenient presentation, it should be understood that this manner of description encompasses rearrangement, unless a particular ordering is required by specific language set forth herein. For example, operations described sequentially may in some cases be rearranged or performed concurrently. Moreover, for the sake of simplicity, the attached figures may not show the various ways in which the disclosed methods can be used in conjunction with other methods.

Having illustrated and described the principles of the illustrated embodiments, the embodiments can be modified in various arrangements while remaining faithful to the concepts described above. In view of the many possible embodiments to which the principles of the illustrated embodiments may be applied, it should be recognized that the illustrated embodiments are only examples and should not be taken as limiting the scope of the disclosure. We claim all that comes within the scope of the appended claims.

The invention claimed is:

1. A method of issuing a gaming challenge comprising:

at a client computing device using one or more processors:

transmitting challenge information for receipt at a gaming service, the challenge information comprising:

participant information identifying a plurality of challenge participants, the challenge participants comprising a challenger and one or more challengees, the one or more challengees selected by the challenger;

game information identifying a gaming application to be played as part of the gaming challenge, the gaming application selected by the challenger from a plurality of gaming applications; and

leaderboard information identifying a leaderboard associated with the gaming application, the leaderboard ranking at least the challenger and the one or more challengees according to a game metric associated with the gaming application;

receiving, from the gaming service, leaderboard ranking information associated with the identified leaderboard for at least two of the challenge participants within the leaderboard;

based on the leaderboard ranking information and the game metric for the challenger at completion of play of the gaming application, determining that a rank of the challenger has changed relative to a rank of at least one of the challengees within the leaderboard; and

responsive to the determining that the rank of the challenger has changed, transmitting a challenge rank change notification, to the gaming service, to update the leaderboard at the gaming service, the challenge rank change notification indicating that the rank of the challenger has changed relative to the rank of at least one of the challengees, so that the challenge rank change notification passes only in a direction from the client computing device to the gaming service.

2. The method of claim **1**, wherein the challenge information further comprises challenger avatar expression information indicating how a challenger avatar is to be animated when the challenger avatar is displayed as part of a challenge request at a display of a computing device operated by a challengee.

3. The method of claim **1**, wherein the gaming application is played as a single-player game.

4. The method of claim **1**, wherein the challenge information further comprises a challenge message, the method further comprising prompting the challenger for the challenge message, the prompting comprising presenting a user interface at a display of the client computing device, the user interface comprising a challenge message window pre-populated with a pre-populated challenge message based on a challenge history between the challenger and at least one of the one or more challengees.

5. The method of claim **1**, wherein the challenge information further comprises challenge type information indicating a challenge type, duration information indicating a duration for the challenge, and challenge criteria information indicating one or more criteria to be satisfied in order for the gaming challenge to be met.

6. The method of claim **5**, wherein the challenge type is a tournament challenge type for which the gaming challenge comprises a plurality of challenges between pairs of the challenge participants.

7. The method of claim **1**, wherein the challenge information further comprises award information indicating an avatar awardable to be awarded to a winner of the gaming challenge.

8. The method of claim **1**, further comprising:

outputting at a display of the client computing device information indicating relative rankings within the leaderboard for the at least two challenge participants, wherein the relative rankings comprise a position of one of the challenge participants relative to other challenge participants within the leaderboard.

9. The method of claim **1**, further comprising:

receiving challenge response information comprising information indicating that a responding challengee has accepted or declined the gaming challenge, and responding challengee avatar expression information; and

outputting at a display of the client computing device information indicating that the responding challengee has accepted or declined the gaming challenge, and a responding challengee avatar animated according to the responding challengee avatar expression information.

10. One or more non-volatile computer-readable storage media storing computer-executable instructions, which when executed by a client computing device, cause the client computing device to perform a method of accepting a gaming challenge by a challengee, the method comprising:

at the client computing device of the challengee:

receiving, from a gaming service, challenge information, the challenge information comprising:

participant information identifying a challenger, the challenger having selected the challengee for the gaming challenge;

game information identifying a gaming application to be played as part of the gaming challenge, the gaming application selected by the challenger from a plurality of gaming applications; and

leaderboard information identifying a leaderboard associated with the gaming application, the leaderboard ranking at least the challenger and the challengee according to a game metric associated with the gaming application;

receiving, from the gaming service, leaderboard ranking information for challenge participants, the challenge participants comprising the challenger and the challengee;

based on the leaderboard ranking information and the game metric for the challengee at completion of play of the gaming application, determining that a rank of the challengee within the leaderboard has changed relative to a rank of at least one of the other challenge participants; and

responsive to the determining that the rank of the challengee has changed, transmitting a challenge rank change notification, to the gaming service, to update the leaderboard at the gaming service with the current game metric for the challengee, the challenge rank change notification indicating that the rank of the challengee has changed relative to the rank of at least one of the other challenge participants, the challenge rank change notification passing only in a direction from the client computing device to the gaming service.

11. The one or more non-volatile computer-readable storage media of claim **10**, wherein the challenge information further comprises challenger avatar expression information, the method further comprising outputting a challenge request at a display of the client computing device, the outputting comprising animating a challenger avatar according to the challenger avatar expression information.

12. The one or more non-volatile computer-readable storage media of claim **10**, wherein the challenge information further comprises challenger avatar expression information, the method further comprising:

outputting a notification at the display of the client computing device that the gaming challenge has been issued; and

in response to selection of the notification, outputting an interstitial page at the client computing device comprising a challenger avatar animated according to the challenger avatar expression information.

13. The one or more non-volatile computer-readable storage media of claim **10**, wherein the method further comprises transmitting challenge response information to the gaming service, the challenge response information comprising information indicating whether the challengee has accepted or declined the gaming challenge, and challengee avatar expression information.

14. The one or more non-volatile computer-readable storage media of claim 10, wherein the method further comprises maintaining at the client computing device a challenge record for the gaming challenging, the challenge record comprising local ranking information indicating the rank of at least two of the challenge participants within the leaderboard, wherein the determining that the rank of the challengee has changed comprises comparing the leaderboard ranking information to the local ranking information.

15. The one or more non-volatile computer-readable storage media of claim 10, wherein the method further comprises:

receiving challenge rank change information from the gaming service indicating that a rank of the challengee using the client computing device within the leaderboard has changed relative to a rank of at least one other challenge participant; and

outputting a challenge rank change notification at a display of the client computing device indicating that the rank of the challengee using the client computing device has changed relative to the rank of at least one other challenge participant.

16. The one or more non-volatile computer-readable storage media of claim 10, wherein the challenge information comprises challenge criteria information indicating one or more criteria to be satisfied in order for the gaming challenge to be met, the method further comprising:

determining that the challengee using the client computing device has satisfied the challenge criteria; and

transmitting a challenge complete notification to the gaming service indicating that the challengee using the client computing device has met the gaming challenge.

17. A client computing device comprising at least one processor and memory, the memory storing computer-executable instructions for causing the client computing device to perform a method of issuing a gaming challenge, the method comprising:

at the client computing device:

transmitting challenge information for receipt at a gaming service, the challenge information comprising:

participant information identifying a plurality of challenge participants, the challenge participants comprising a challenger and one or more challengees, the one or more challengees selected by the challenger;

game information identifying a gaming application to be played as part of the gaming challenge, the gaming application selected by the challenger from a plurality of gaming applications;

challenge criteria information identifying one or more challenge criteria to be satisfied in order for the gaming challenge to be met;

challenge duration information indicating a duration of the gaming challenge; and

leaderboard information identifying a leaderboard associated with the gaming application to be used in determining whether the gaming challenge has been met, the leaderboard ranking at least the challenger and the one or more challengees according to a game metric associated with the gaming application;

receiving, from the gaming service, leaderboard ranking information associated with the identified leaderboard indicating a rank within the leaderboard for at least two of the challenge participants;

outputting, at a display of the client computing device, information indicating relative rankings within the leaderboard for the at least two challenge participants, wherein the relative rankings comprise a position of one of the challenge participants relative to other challenge participants within the leaderboard;

based on the leaderboard ranking information and the game metric for the challenger at completion of play of the gaming application, determining that a rank of the challenger has changed relative to a rank of at least one of the challengees within the leaderboard; and

responsive to the determining that the rank of the challenger has changed, transmitting a challenge rank change notification, to the gaming service, to update the leaderboard at the gaming service with the game metric for the challenger, the challenge rank change notification indicating that the rank of the challenger has changed relative to the rank of at least one of the challengees, the challenge rank change notification passing only in a direction from the client computing device to the gaming service;

receiving challenge rank change information, from the gaming service, indicating that the rank of a challenger within the leaderboard has changed relative to the rank of at least one of the challengees;

outputting, at the display of the client computing device, a challenge rank change notification indicating that the rank of the challenger has changed relative to the rank of at least one of the challengees;

determining that the challenge has been completed due to the challenger satisfying the challenge criteria or the challenge duration having expired; and

transmitting a challenge complete notification to the gaming service.

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